DEPARTMENT OF COMPUTER SCIENCE

RATHINAM COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

Rathinam Techzone, Pollachi Road, Eachanari,

Coimbatore – 641021

Celebrate life

RATHINAM

Syllabus for

M.Sc. Computer Science

(M.Sc. CS)

(I - IV Semester)

2021 – 2022 Batch onwards

Vision and Mission of the Institution:

VISION

To emerge as a world-renowned Institution that is integrated with industry to impart Knowledge, Skills, Research Culture and Values in youngsters who can accelerate the overall development of India.

MISSION

To provide quality education at affordable cost, build academic and research excellence maintain eco-friendly and robust infrastructure, and to create a team of well qualified faculty who can build global competency and employability among the youth of India

MOTTO

Transform the youth into National Asset.

Vision and Mission of the Department:

Vision

Build a strong research and teaching environment aimed towards betterment of society and industrial needs.

Mission

To provide quality undergraduate and post graduate education in both the theoretical and applied foundations of computer science and prepare the students for a globalised technological trend, knowledge in research towards serving the society.

Program Educational Objectives (PEO)

PEO1	:	To apply hardware and software technologies that provides computing solutions for successful careers in industry/higher education/research.
PEO2	:	To set the foundation of mathematics, computer science, and problem-solving methodology for effective implementation in the area of software services and developments.
PEO3	:	To become entrepreneurs/innovators to apply the principles of system analysis, design, development, and project management to address social, technical, and business challenges.
PEO4	:	To promote awareness and to acquire leadership qualities with strong communication skills along with professional and ethical values.
PEO5	:	To adopt lifelong learning, act with Integrity, and have interpersonal skills needed to engage with commitment towards social responsibilities and maintain high ethical standards.

Mapping of Institute Mission to PEO

Institute Mission	**PEO's**
To provide quality education at affordable cost, build academic and research excellence maintain eco-friendly and robust infrastructure, and	PEO1, PEO2
To create a team of well qualified faculty who can build global competency and employability among the youth of India.	PEO2, PEO5

Mapping of Department Mission to PEO

Department Mission	**PEO's**
To provide quality undergraduate and post graduate education in both the theoretical and applied foundations of computer science.	PE02, PE05
Prepare the students for a globalised technological trend, knowledge in research towards serving the society.	PEO3, PE04, PE05

Program Outcomes (PO):

PO1	:	To apply fundamental knowledge of computing, mathematics, and science relevance to the discipline.
PO2	:	To design, implement, and evaluate a computer-based system, process, component, or program for various applications.
PO3	:	To use current techniques, skills, and modern tools necessary for research-based knowledge and research methods for the cultural, societal, environmental considerations and demonstrate the knowledge of and need for sustainable development.
PO4	:	To formulate models, design, and conduct experiments for interpreting data and critical thinking.
PO5	:	To apply ethical principles, commit to professional ethics and responsibilities of the computing practice and its solutions.
PO6	:	Development of emphatic written and verbal communication skills.
PO7	:	To function individually and on teams, including diverse and multidisciplinary, to accomplish a common goal.
PO8	:	Continuous professional development through long term learning.
PO9	:	To solidify the computing principles to apply for one's own work, as a member and leader in a team, to manage projects.

Program Specific Outcomes (PSO):

PSO1	:	Enrich the knowledge in the areas of choose to study any one subject among recent trends in IT provided in the optional subjects.
PSO2	:	Students understand all dimensions of the concepts of software applications and projects. Students understand the computer subjects with a demonstration of all programming and theoretical concepts with the use of ICT.
PSO3	:	Developed in-house applications in terms of projects. Interact with IT experts & knowledge by IT visits.
PSO4	:	Get industrial exposure through the 6 months of an Industrial Internship in the IT industry. To make them employable according to the current demand of IT Industry and responsible citizen. Aware them to publish their work in reputed journals.

Correlation between the PO/PSO and the PEOs

Program Outcomes		PEO1	PEO2	PEO3	PEO4	PEO5
PO1	:	1	2	2	2	2
PO2	:	3	1	1	3	3
PO3	:	2	2	2	2	1
PO4	:	3	3	1	3	3
PO5	:	3	2	3	2	3
PO6	:	3	3	2	2	1
PO7	:	2	1	3	2	3
PO8	:	2	2	1	2	3
PO9	:	3	3	3	2	2
PSO1	:	1	2	2	2	3
PSO2	:	3	3	2	1	2
PSO3	:	2	2	3	3	3
PSO4	:	1	3	3	2	3

Components considered for Course Delivery is listed below:

1. Class room Lecture
2. Laboratory class and demo
3. Assignments
4. Mini Project
5. Project
6. Online Course
7. External Participation
8. Seminar
9. Internship

Mapping of POs with Course Delivery:

Program Outcomes	Course Delivery								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
PO1	3	3	3	2	3	3	3	3	3
PO2	2	3	2	3	2	3	1	3	2
PO3	3	1	2	2	3	3	3	2	3
PO4	3	3	3	1	2	2	2	3	3
PO5	1	2	2	2	3	2	2	2	2
PO6	3	3	3	3	3	1	2	3	3
PO7	3	3	3	2	3	1	3	2	3
PO8	3	3	2	3	3	2	2	3	1
PO9	2	3	1	3	1	3	3	3	3
PSO1	3	3	3	1	3	3	3	2	3
PSO2	3	2	3	3	2	3	1	3	2
PSO3	3	1	2	3	3	2	2	1	2
PSO4	3	3	2	2	1	2	3	3	3

RATHINAM COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

M.Sc. Computer Science Curriculum Structure – Regulation - 2021

(for the students admitted in the Batch during 2021 onwards)

S.No	Sem	Part	Type	Subject	Credit	Hour	Int	Ext	Total
1	1	III	Theory	Core– I	4	5	50	50	100
2	1	III	Theory	Core– II	4	5	50	50	100
3	1	III	Theory	Core– III	4	5	50	50	100
4	1	III	Theory	Core– IV	4	5	50	50	100
5	1	III	Practical	Core Practical – I	4	5	50	50	100
6	1	III	Practical	Core Practical – II	4	5	50	50	100
7			ALC1	ALC	2				100
8			ALC2	ALC	2				100
					28	30			
1	2	III	Theory	Core– V	4	5	50	50	100
2	2	III	Theory	Core– VI	4	4	50	50	100
3	2	III	Theory	Core– VII	4	4	50	50	100
4	2	III	Theory	Core– VIII	4	5	50	50	100
5	2	III	Practical	Core Practical – III	4	4	50	50	100
6	2	III	Practical	Core Practical – IV	4	4	50	50	100
7	2	III	Practical	Core Practical – V	4	4	50	50	100
8			ALC3	ALC	2				100
9			ALC4	ALC	2				100
					32	30			
1	3	III	Theory	Core– IX	4	4	50	50	100
2	3	III	Theory	Core– X	4	4	50	50	100
3	3	III	Theory	Core– XI	4	4	50	50	100
4	3	III	Theory	Elective - I	4	5	50	50	100
5	3	III	Theory	Elective - II	4	5	50	50	100
6	3	III	Practical	Core Practical – V	4	4	50	50	100
7	3	III	Practical	Core Practical VI	4	4	50	50	100
8	3	III	ALC 5	ALC	2		50	50	100
9	3	III	Practical	Core Practical – VII – Industrial Training Report	2		50		50
					32	30			

1	4	III	Theory	Core– XII	4	5	50	50	100
2	4	III	Theory	Core– XIII	4	5	50	50	100
3	4	III	Theory	Elective- III	4	5	50	50	100
4	4	III	Project	Core Project	8	15	100	100	200
					20	**30**			
					112	**120**	**1300**	**1250**	**3050**

Core				
S.No	**Course Code**	**Course**	**Pre-requesite**	**Offering Department**
		Pro-Python Programming		
		Analysis and Design Algorithm		
		Python Programming & Algorithms Lab		
		Shell Programming		
		Modern Operating System		
		Shell Programming & OS Lab		
		Web Application Hackers		
		Web Applications Lab		
		Advanced Database System		
		Database Lab		
		Research Methodology		
		Advanced Computer Network		
		Computer Network Lab		
		R Programming		
		Big Data Analytics		
		Data Analytics Lab		
		Cryptography & Network Security		
		Network Security Lab		
		Cyber Law & Ethical Hacking		
		Block Chain Technology		

Specializations Core				
S.No	**Course Code**	**Course**	**Pre-requesite**	**Offering Department**
		Digital Forensics and Investigations		
		Cyber Security Incident Response Management		
		Advanced Network Security		
		Advanced Network Security Lab		
		Python Programming		
		Python Programming Lab		
		IT Governance, risk, compliance and Information Security Audit		
		Server-Side Scripting		
		Server-Side Scripting Lab		
		Linux Security and Forensics		
		Linux Security and Forensics Lab		
		Advance Ethical Hacking		
		Advance Ethical Hacking Lab		
		Malware Analysis		
		Malware Analysis Lab		
		Server Security		
		Cyber Forensics		
		Cyber Laws		
		Information Security Policies in Industry		

List of Electives:

Elective	Subject Name
Elective – I	Distributed Networks
	Social Network Analytics
	Computer Graphics and Multimedia
	Software Testing
	Cloud Management and Security
	Cloud Security
	Storage Management and Security
Elective – II	Wireless Network Security
	Streaming Analytics
	3D Animation Essentials
	Tools for Software Testing
	Deploying and Managing a Cloud Infrastructure
	Forensic Psychology & Crime Assessment
	Fingerprints and Impressions
Elective – III	VMware Network Virtualization
	Business Intelligence and Data Analytics
	Virtual Reality
	Agile Testing
	Hybrid Cloud
	Open Web Application Security Project (OWASP) Framework
	End Point Security Management

ADVANCED LEARNER COURSE:

ALC	COURSE
ALC1	Database Security
ALC2	Security Architecture
ALC3	Mobile Device Forensics
ALC4	Web Application and Web Security
ALC5	File System Forensic Analysis

SYLLABUS

CORE

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Pro-Python Programming	**4**	**5**	**5**	**0**	**Theory**

Introduction:
To provide an introduction to Python. The course will discuss topics necessary for the participant to be able to create and execute Python programs. The lectures and presentations are designed to provide knowledge and experiences to students that serve as a foundation for continued learning of presented areas.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To acquire programming skills in core Python.
CO2	:	To acquire Object Oriented Skills in Python
CO3	:	To be able to read data from a text file using Python
CO4	:	Discover the need for working with the Documentation and Utilities
CO5	:	Plot data using appropriate Python visualization libraries

Unit I: [12 Periods]
Principles and Philosophy – The Zen of Python – Advanced Basics – General Concepts – Control Flow – Iteration – Collections – Importing Code – Functions – Arguments – Decorators – Function Anntations – Generators – Lambdas – Introspection – Exciting Python extensions: Statistics.

Unit II: [12 Periods]
Classes - Inheritance – How Classes are Created – Attributes – Methods – Magic Methods –
Exciting Python extensions: Iterators – Common Protocols – Basic Operations – Numbers – Iterables – Sequences – Mappings – Callables – Context Managers – Exciting Python Extensions: Scrapy.

Unit III: [12 Periods]
Object Management – Namespace Dictionary – Garbage Collection – Pickling – Copying – Exciting Python Extensions: Beautiful Soup – Strings – Bytes – Text – Simple Substitution – Formatting – Exciting Python Extensions: Feedparser.

Unit IV: [12 Periods]
Documentation – Proper Naming – Docstrings – Documentation Outside the Code – Documentation Utilities – Exciting Python Extensions: NumPy – Testing – Test-Driven Development – Doctests – The Unittest Module – Providing a custom Test class.

Unit V: [12 Periods]

Distribution – Licensing – Packaging – Exciting Python Extensions: Secrets Module – Sheets: A CSV Framework – Building a Declarative Framework – Building the Framework – Ordering Fields – Building a Field Library – Getting Back to CSV.

Textbook:

1. J.Burton Browning, Marty Alchin,"Pro Python 3 – Features and Tools for Professional Development", Third Edition, Apress (2019).

Reference Books:

1. Jonathan Yates, "Python Programming Practical Python Programming For Beginners and Experts", (2017).
2. Adam Stewart, "Python Programming Python Programming for Beginners", (2016).
3. Allen B. Downey- ``Think Python: How to Think Like a Computer Scientist''- 2nd edition- Updated for Python 3- Shroff/O'Reilly Publishers, (2016).
4. Shroff "Learning Python: Powerful Object-Oriented Programming; Fifth edition, (2013).
5. David M. Baezly "Python Cookbook" O'Reilly Media; Third edition (2013).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**1**	**3**	**1**		**2**		**3**				**2**		**3**
CO2		**2**		**3**		**2**		**3**		**2**			**1**
CO3	**3**		**3**	**2**	**3**		**1**	**2**		**1**		**3**	
CO4	**3**		**2**		**1**	**3**			**3**		**3**		**2**
CO5	**2**	**3**		**1**			**3**		**1**			**3**	

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Analysis and Design Algorithm	**4**	**5**	**5**	**0**	**Theory**

Introduction:
To provide the theoretical backbone of computer science and are a must in the daily work of the successful programmer. To provide a solid background in the design and analysis of the major classes of algorithms. At the end of the course students will be able to develop their own versions for a given computational task and to compare and contrast their performance.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To Apply design principles and concepts to algorithm design
CO2	:	Developing efficient algorithms for simple computational tasks
CO3	:	Have the mathematical foundation in analysis of algorithms
CO4	:	Analyze the efficiency of algorithms using time and space complexity theory
CO5	:	Knowing and understanding a wide range of Linear programming and Parallel algorithms

Unit I: [12 Periods]
Introduction to Algorithms – Basics of Algorithm Writing – Tools for Problem-solving – Algorithm Specification – Basics of Algorithm Analysis – Introduction to Time Complexity – Mathematical Analysis of Recursive Algorithms.

Unit II: [12 Periods]
Data Structures and Algorithms – Introduction to Dictionary – Priority Queues and Heaps – Brute Force Approaches – Sequential Search – Sorting Problem – Divide-and-Conquer Approach – Merge Sort – Quick Sort – Fourier Transform.

Unit III: [12 Periods]
Decrease-and-Conquer Approach – Introduction – Decrease by Constant method – Time-Space Tradeoffs – Introduction – Linear Sorting – Hashing and hash Tables – B-Trees – Greedy Algortihms – Transform-and-conquer Approach.

Unit IV: [12Periods]
Dynamic Programming – Backtracking – N-queen Problem – Sum of Subsets – Vertex Colouring Problem – Hamiltonian Circuit Problem – Branch-and-bound Techniques – String Algorithms – Basic String Algorithms.

Unit V: [12 Periods]

Iterative Improvement and Linear Programming – Basics of Computational Complexity - Randomized and Approximation Algorithms – Introduction to Approximation Algorithms – Parallel Algorithms – Introduction to Parallel Processing.

Textbook:

1. S.Sridhar," Design and Analysis of Algorithms", Oxford University Press, First Publication, (2014)

Reference Textbooks

1. Ellis Horowitz, Satraj Sahni and Rajasekaran, "Computer Algorithms/C++", 2nd Edition, Universities Press, (2014).
2. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition, PHI,(2010).
3. Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 3rd Edition, pearson, (2012).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**1**	**3**		**3**		**2**				**3**	**3**		**3**
CO2		**2**	**3**		**1**		**3**	**2**	**3**				
CO3	**2**	**1**	**2**			**1**				**2**	**1**	**3**	**2**
CO4	**3**			**1**	**3**	**3**			**1**	**3**		**1**	**3**
CO5		**3**			**2**		**2**	**3**			**1**		

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Python Programming & Algorithms Lab	**4**	**0**	**0**	**5**	**Practical**

1. a) To write a python program that takes in command line arguments as input and print the number of arguments.

   b) To write a python program find the square root of a number (Newton's method)

2. a) To write a python program exponentiation (power of a number).

b) To write a python program to compute the GCD of two numbers.

c) To write a python program first n prime numbers.

3. a)To write a python program find the maximum of a list of numbers.

   b) To write a python program to perform Matrix Multiplication.

4. To write a python program to find the most frequent words in a text file.

5 a) To write a python program Travelling Salesman Problem.

   b) To write a python program Linear search

6. a) To write a python program N-queen Problem.

   b) To write a python program Quick Sort.

7. a) To write a python program hash Table.

   b) To write a python program Merge Sort.

8. To write a python program simulate bouncing ball in Pygame.

9. a) To demonstrate working of classes and objects

   b) To demonstrate constructors

   c) To demonstrate class method and static method

10. a) Concept of polymorphism in python (method overloading and overriding)

    b) To demonstrate inheritance

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	3			2		2			3	3		
CO2			3		3		3		3		3	2	1
CO3	2	2		1		3	3	3					3
CO4		3		3		1					2		
CO5	1		2		3			2	1	2		3	

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Shell Programming	**4**	**5**	**5**	**0**	**Theory**

Introduction:
To give students knowledge about File systems and use of basic Commands and Shell programming

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Understanding the basic set of commands and utilities in Linux/UNIX systems.
CO2	:	To learn to develop software for Linux/UNIX systems.
CO3	:	To learn the important Linux/UNIX library functions and system calls
CO4	:	To obtain a foundation for an advanced course in operating systems
CO5	:	To understand the concept of web processing and file systems in linux.

Unit I: [12 Periods]
Introduction - Displaying in the terminal - Using with variables and environment variables - Playing with file descriptors and redirection - Arrays and associative arrays - Visiting aliases - Grabbing information about the terminal - Debugging the Script - Functions and arguments - Reading n characters without pressing the return key - Concatenating with cat - Recording and playing back of terminal sessions - Playing with xargs - Translating with tr - Checksum and verification - Cryptographic tools and hashes - Sorting unique and duplicates - Splitting files and data - Slicing filenames based on extension - Renaming and moving files in bulk - Spell checking and dictionary manipulation - Automating interactive input - Making commands quicker by running parallel processes.

Unit-II: [12 Periods]
Generating files of any size - Making files immutable - Generating blank files in bulk - Finding symbolic links and their targets - Enumerating file type statistics - Using loopback files - Creating ISO files and hybrid ISO - Listing only directories – alternative methods - Fast command-line navigation using pushd and popd - Printing the directory tree – Manipulating video and image files - Texting and Driving – Using regular expressions - Searching and mining a text inside a file with grep - Cutting a file column-wise with cut - Using sed to perform text replacement - Using awk for advanced text processing - Printing text between line numbers or patterns - Printing lines in the reverse order - Parsing e-mail addresses and URLs from a text - Text slicing and parameter operations.

Unit-III: [12 Periods]

Downloading from a web page - Downloading a web page as plain text - A primer on cURL- Accessing unread Gmail e-mails from the command line - Parsing data from a website - Image crawler and downloader - Posting to a web page and reading response - Summarizing text with OTS - Creating a new git repository - Cloning a remote git repository - Creating and merging branches with git - Pushing a branch to a server - Checking the status of a git repository - Viewing git history - Finding bugs - Tagging snapshots - Committing message ethics - Using fossil - Opening a fossil project - sharing your work with fossil - Updating your local fossil repository- viewing fossil history.

Unit-IV: [12 Periods]

Archiving with tar - Archiving with cpio - Compressing data with gzip - Archiving and compressing with zip - Faster archiving with pbzip2 - Creating filesystems with compression - Backup snapshots with rsync - Differential archives - Creating entire disk images using fsarchiver - The Old-Boy Network - Let us ping - Tracing IP routes - Running commands on a remote host with SSH - Connecting to a wireless network – Password-less auto-login with SSH – Port forwarding using SSH – Mounting a remote drive at a local mount point - Network traffic and port analysis - Measuring network bandwidth - Creating artbitrary sockets - Building a bridge - Sharing an internet Connection – Basic firewall using iptables – Creating a virtual private network.

Unit-V: [12 Periods]

Gathering information about processes - Killing processes, sending and responding to signals - sending messages to user terminals - The/Proc filesystem - gathering system information - Scheduling with a cron - Databases styles and users - Writing and reading MySQL database from Bash - Bulk image resizing and format conversion - Taking screenshots from the terminal - Managing multiple terminals from one - Tracing the clues - Tracing packets with tcpdump - Tracing network routes with ip - Tracing system calls with strace - Tracing dynamic library functions with trace - tuning a Linux system.

Text Book :

1. Clif Flynt, ShantanuTushar, SarathLakshman “Linux Shell Scripting - Cookbook”, Packt Publishing Ltd., Third Edition, (2017).

Reference Book:

1. Eric Foster Johnson, John C. Welch and Micah Anderson, “ Beginning Shell Scripting”,Wiley, (2005).
2. Carl Albing, JP Vossen and Cameron Newham,“Bash Cookbook”, O’Reilly Media, (2007).
3. Richard Blum, “Linux Command Line and Shell Scripting Bible”, Wiley, (2008).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**3**				**3**		**3**		**3**		**3**		**3**
CO2	**2**	**3**		**2**	**3**	**2**		**3**				**3**	
CO3	**3**	**2**	**3**			**3**	**2**		**2**	**1**	**3**		**1**
CO4			**2**	**3**	**3**					**1**		**2**	**2**
CO5	**1**	**3**		**1**		**2**	**2**		**3**		**1**		

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Modern Operating System	**4**	**5**	**5**	**0**	**Theory**

Introduction:
To design and understand the following OS components: System calls, Schedulers, Memory management systems, Virtual Memory and Paging systems. To evaluate, and compare OS components through instrumentation for performance analysis.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To understand the fundamental concepts and techniques of Operating Systems.
CO2	:	To study the concepts in process management and concurrency control mechanisims
CO3	:	To understand the concepts in memory managements and deadlocks
CO4	:	To study on Virtualization and the Cloud
CO5	:	An ability to compare Various file Security with Interface design

Unit I: [12 Periods]
Introduction – What is an Operating System – History of Operating System – Computer Hardware Review – The Operating System – Operating System Concepts – System Calls – Operating System Structure – The World According to C – Processes and Threads – Interprocess Communication – Scheduling – Classical IPC Problems.

Unit II: [12 Periods]
Memory Management – No Memory Abstraction – A Memory Abstraction: Address Spaces – Virtual Memory – Page Replacement Algorithms – Design Issues for Paging Systems – Implementation Issues – Segmentation – File Systems – Files – Directories – File-System Implementations - File-System Management and Optimization.

Unit III: [12 Periods]
Input/Output – Principles of I/O Hardware – Principles of I/O Software – I/O Software Layers – Disks – Clocks – User Interfaces: keyboard, Mouse, Monitor – Thin Clients – Power Management – Deadlocks – Resources – Introduction to Deadlocks – The Ostrich Algorithm – Deadlock Detection and Recovery – Deadlock Avoidance – Deadlock Prevention – Other Issues.

Unit IV: [12 Periods]

Virtualization and the Cloud – History – Requirements for Virtualization – Type1 and Type2 Hypervisors – Techniques for Efficient Virtualization – Are Hypervisors Microkernels done Right? – Memory Virtualization – I/O Virutalization – Virtual Appliances – Virtual Machines on Multicore CPUs – Licensing Issues – Clouds.

Unit V: [12 Periods]

Security – The Security Environment – Operating System Security – Case Study: Unix, Linux, Android and Window – Operating System Design – The Nature of the Design Problem – Interface Design – Implementation – Performance – Project Management – trends in Operating System Design.

Textbook:

1. Andrew S.Tanenbaum, "Modern Operating Systems", Fourth Edition, Pearson, (2015).

Reference Books:

1. Jonathan Levin, "Mac OS X and iOS Internals: To the Apple's Core", John Wiley & Sons, (2012).
2. Mike Ebbers, John Kettner, WayneO" Brien, BillOgden, "Introduction to the New Mainframe: OS Basics", International Business Machines Corporation, Third Edition, (2011).
3. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts", Wiley, Eighth edition, (2008).
4. Abraham Silberstaz, Peter B Galvin, Greg Gagne, "Operating Systems", 7th edition, John Wiley, (2004).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3		3			3	1	2		3			3
CO2	1	2		2	3		2				3		
CO3		2	1		2	2	3		1	3		3	3
CO4	3	1	2	3		1		3		2		1	
CO5	1	3			1				3		2		

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Shell Programming & OS Lab	**4**	**0**	**0**	**5**	**Practical**

1. Write programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir
2. Write programs using the I/O system calls of UNIX operating system (open, read, write, etc)
3. Write shell programs to simulate UNIX commands like ls, grep, etc.
4. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.
5. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.
6. Developing Application using Inter Process communication (using shared memory, pipes or message queues)
7. Implement the Producer – Consumer problem using semaphores (using UNIX system calls).
8. Implement some memory management schemes – I
9. Implement some memory management schemes – II
10. Implement any file allocation technique (Linked, Indexed or Contiguous)

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	2		2			3	3		1	3		3	
CO2	3	1		1	3			2			2		2
CO3	1			3		2		1	3	2		1	
CO4		3	1				3				1		3
CO5			3	2		1	2		3	1		3	

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Web Application Hackers	**4**	**5**	**5**	**0**	**Theory**

Introduction:
It is a practical guide to discovering and exploiting security flaws in web applications. By "web applications" we mean those that are accessed using a web browser to communicate with a web server. To learn how to run port scans, attack firewalls, or break into servers in other ways. To know how to hack into a web application, steal sensitive data, and perform unauthorized actions.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To address the fundamental problem that all user input is untrusted.
CO2	:	To implemented within web applications the most mechanisms
CO3	:	To advanced exploitation techniques involving out-of-band channels, inference, and time delay
CO4	:	To become a truly accomplished web application hacker
CO5	:	To defects in their configuration and security flaws within the web server software

Unit I: [12 Periods]
Web Application in Security - The Evolution of Web Applications – Web Application Security – Core Defense Mechanisms – Handling User Access – Handling User Input – Handling Attackers – Web Application Technologies – The HTTP Protocol – Web Functionality –Encoding Schemes – Mapping the Application – Enumerating Content and Functionality – Analyzing the Application.

Unit II: [12 Periods]
Bypassing Client-Side Controls – Transmitting Data Via the Client – Capturing User Data: HTML Forms – Capturing User Data: Browser Extensions – Handling Client-Side Data Securely – Attacking Authentication – Authentication Technologies – Design Flaws in Authentication Mechanisms – Implementation Flaws in Authentication – Securing Authentication – Attacking Session Management – Attacking Access Controls

Unit III: [12 Periods]
Attacking Data Stores – injecting into Interpreted Contexts – Injecting into SQL – Injecting into NoSQL –injecting into MongoDB - Injecting into XPath – Injecting into LDAP – Attacking Back-End Components – Injecting OS Commands - Injecting into XML Interpreters - Injecting into Back-end HTTP Requests - Injecting into Mail Services - Attacking Application Logic - Attacking Users: Cross-Site Scripting

Unit IV: [12 Periods]

Attacking Users: Other Techniques - Capturing Data Cross-Domain - The Same-Origin Policy Revisited - Other Client-Side Injection Attacks - Local Privacy Attacks - Attacking ActiveX Controls - Attacking the Browser - Automating Customized Attacks - Enumerating Valid Identifi ers - Harvesting Useful Data - Fuzzing for Common Vulnerabilities - Exploiting Information Disclosure - Exploiting Error Messages - Attacking Native Compiled Applications - Buffer Overflow Vulnerabilities.

Unit V: [12 Periods]

Attacking Application Architecture - Attacking the Application Server - Finding Vulnerabilities in Source Code - Approaches to Code Review - The Java Platform - ASP.NET – PHP – Perl – JavaScript - Database Code Components - Tools for Code Browsing - A Web Application Hacker's Toolkit - Web Browsers - Integrated Testing Suites - Standalone Vulnerability Scanners - Other Tools - A Web Application Hacker's Methodology

Textbook:

1. Dafydd Stuttard, marcus Pinto, "The Web Application Hacker's Handbook: Finding and Exploiting Secuirty Flaws", Wiley Publishing, Second Edition, (2011)

Reference Books:

1. Joel Scambray, Vincent Liu, Caleb Sima, "Hacking Exposed Web Applications: Web Application Security Secrets and Solutions", Mc Graw Hill, Third Edition, (2011).
2. Michal Zalewski, "The Tangled Web: A guide to securing Modern Web Applications" San Francisco, (2012).
3. John Paul Mueller, "Security for Web Developers", O'Reilly, First Edition (2016).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	1	3		3		1	2	3		3		3	1
CO2	2		3	1	3			3	3		1		2
CO3	3	1			1	2	1		1		2	3	
CO4		2		2		3		2		2	3	2	
CO5	3		1	3	2		3		2	3			3

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Web Applications Lab	**4**	**0**	**0**	**4**	**Practical**

1. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient
2. Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format.
3. Write a JavaScript code that displays text “TEXT-GROWING” with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays “TEXT-SHRINKING” in BLUE color. Then the font size decreases to 5pt.
4. Develop and demonstrate a HTML5 file that includes JavaScript script that uses functions for the following problems:
   a. Parameter: A string Output: The position in the string of the left-most vowel
   b. Parameter: A number Output: The number with its digits in the reverse order
5. Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include USN, Name, and Name of the College, Branch, Year of Joining, and email id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.
6. Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.
7. Write a ASP program to display a digital clock which displays the current time of the server.
8. Write the PHP programs to do the following:
   a. Implement simple calculator operations.
   b. Find the transpose of a matrix.
   c. Multiplication of two matrices.
   d. Addition of two matrices.
9. Write a PHP program named states.py that declares a variable states with value "Mississippi Alabama Texas Massachusetts Kansas". write a PHP program that does the following:
   a. Search for a word in variable states that ends in xas. Store this word in element 0 of a list named statesList.

b. Search for a word in states that begins with k and ends in s. Perform a case insensitive comparison. [Note: Passing re.Ias a second parameter to method compile performs a case-insensitive comparison.] Store this word in element1 of states List.

c. Search for a word in states that begins with M and ends in s. Store this word in element 2 of the list.

d. Search for a word in states that ends in a. Store this word in element 3 of the list.

10. Write a PHP program to sort the student records which are stored in the database by NoSQL using selection sort.
11. Project: Develop a web application project using the languages and concepts learnt in the theory and exercises listed in part A with a good look and feel effects. You can use any web technologies and frameworks and databases.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3		3		2		3		2		3	3	
CO2		1		3	1	2		1		3	2		3
CO3	1	2		2	3	3	2	2	3	1		2	1
CO4		3	1			1			2		3	1	
CO5	3			1		2	3	1	3	2			3

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Advanced Database System	**4**	**4**	**4**	**0**	**Theory**

Introduction:
An introduction to database management systems, with an emphasis on how to organize, maintain and retrieves, efficiently and effectively, information from a DBMS.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To identify advance database concepts and database models
CO2	:	To Apply and analyze various terms related to transaction management in centralized and Relational database Model
CO3	:	To normalization and ER modeling are used concurrently to produce a good database design
CO4	:	To understand the Concurrency Control is and what role it plays in maintaining the databases Integrity
CO5	:	To understand business Intelligence is a comprehensive framework to support business decision making

Unit I: [12 Periods]
Database Concepts: Database Systems – Data Vs Information – Introducing the Database – Why database design is important – Evolution of file system data processing – Problems with file System data processing – Database Systems. – Data Models – Data Modeling and Data Models – The importance of Data Models – Data Model Basic Building Blocks – Business Rule – The Evolution of Data models – Degrees of Data Abstraction.

Unit II: [12 Periods]
Design Concepts: The Relational Database Model – A Logical view of data – Keys – Relational Algebra – The Data Dictionary and The System Catalog – Relationships within the Relational Database – Data Redundancy Revisted – Codd's Relational Database Rules – Entity Relationship (ER) Modeling – Database design challenges: Conflicting Goals – Advanced Data Modeling – The Extended Entity relationship model – Entity Clustering – Entity Integrity – Design Cases -

Unit III: [12 Periods]

Design Concepts: Normalization of Databases Tables – The need of Normalization – The Normalization Process – Normalization and Database Design. – Advanced Design and Implementation: Introduction to Structured Query language – Data Manipulation Commands – Advanced SQL – SQL Join Operators – Subqueries and correlated Queries – SQL Functions – Relational Set Operators – Oracle Sequences – Procedural SQL – Embedded SQL – Database Design – The Database Life Cycle – Conceptual Design – Database Design Strategies.

Unit IV: [12 Periods]

Advanced Database Concepts: Transaction Management and Concurrency Control – Concurrency Control – Concurrency Control with locking methods – Concurrency Control with Optimistic Methods – ANSI levels of Transaction Isolation – Database Recovery management. – Database Performance Turning and Query Optimization – Query Processing – Indexes and Query Optimization – SQL Performance Tuning – Query Formulation – DBMS Performance Tuning – Distributed Database Management System.

Unit V: [12 Periods]

Advanced Database Concepts: Business Intelligence – Business Intelligence Architecture – Decision Support Data – Star Schemas – Online Analytical Processing – SQL Extension for OLAP – Databases and the Internet – Database Connectivity – Extensible Markup language – Database Administration: Database administration and Security – Data as a Corporate Asset – The need for a Database and its Role in an Organization – Introduction of a database Special Considerations – The Evolution of Database Administration – The Database Environment‘s Human Component – Security.

Textbook:

1. Carlos Coronel, Steven Morris, Peter Rob, “Database Systems Design, Implementation and Management”, 12th Edition, Cengage Learning All rights reserved. (2016)

Reference Books:

1. Abraham Silberchatz, Henry F.Korth, S.Sudarshan , “Database System Concepts”, McGraw-Hill, 6th Edition, (2013)
2. Peter Rob and Coronel, “Database Systems: Design, Implementation and Management”, Thomson Learning, Ninth edition, (2009) .
3. C.J.Date, Longman, “Introduction to Database Systems”, Pearson Education. 7th Edition, (2008).
4. Dennis Shasha, “Advanced Database Systems transactions, database tuning, and advanced topics”, (2017).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1		1	2	2		2	3		2		3		1
CO2			3		3		1		1	3		2	3
CO3	2	2		3	1	3		3		1			2
CO4	3		1	3		2		1	3		3	3	
CO5	1	3			3			2		2		1	3

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Database Lab	**4**	**0**	**0**	**4**	**Practical**

1. Distributed Database for Book store.
2. Deadlock Detection Algorithm for distributed database using wait - forgraph.
3. Object Oriented Database – Extended Entity Relationship (EER).
4. Parallel Database – University Counselling for Engineering Colleges
5. Parallel Database –Implementation of Parallel Join & Parallel Sort.
6. Active Database – Implementation of Triggers & Assertions for Bank Database.
7. Deductive Database – Constructing Knowledge Database for Kinship Domain (Family Relations).
8. Study and Working of WEKA Tool.
9. Query Processing – Implementation of an Efficient Query Optimizer.
10. Designing XML Schema for Company Database.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**3**		**2**	**3**			**1**				**3**		**3**
CO2		**3**		**2**	**1**	**3**		**1**	**1**	**3**			
CO3	**2**			**3**		**1**	**3**		**2**	**3**		**2**	
CO4	**3**	**2**			**3**					**1**			**1**
CO5		**3**	**1**		**3**		**2**				**2**	**3**	

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Research Methodology	**4**	**4**	**4**	**0**	**Theory**

Introduction:
To give an introduction about the research methods and design and make the students to know the how to collect the data and create a report on research

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Defining a problem and techniques involves
CO2	:	To Studying the different types of design in research.
CO3	:	To develop skills to collect the data for research and writing a research report
CO4	:	To Understanding the basics of design pattern
CO5	:	Studying the OOSD life cycle and development

Unit I: [12 Periods]
Research: a way of thinking – The research process: its characteristics and requirements – Types of research – The mixed/multiple methods approach - The research process: a quick glance – Step one: Formulating a Research Problem: Reviewing the literature – Formulating a research problem – Identifying variables – Constructing hypothesis.

Unit II: [12 Periods]
Step Two: Conceptualizing a Research Design – Selecting a study design – Quantitative research - Qualitative design. Step Three: Constructing an instrument for Data Collection – Selecting a method of data collection – Methods of data collection in qualitative research – Collecting data using secondary sources. Collecting data using attitudinal scales – Establishing the validity and reliability of a research instrument.

Unit III: [12 Periods]
Step Four: Selecting a Sample – Step Five: Writing a Research Proposal – Step Six: Collecting Data – Considering ethical issues in data collection – to consider concerning research participants – Regarding the sponsoring organization. Step Seven: Processing and Displaying data – Step Eight: Writing a research Report – Developing a draft outline

Unit IV: [12 Periods]

Leveraging Object-oriented Concepts through Design Patterns – Singleton Design Pattern – One and Only One – Singleton in ABAP – Strategy Design Pattern – The right tool for the job – A family of interchangeable features – Strategy in ABAP – Observer Design Pattern – Adapter Design Pattern – Change in Inevitable – Adapter in ABAP.

Unit V: [12 Periods]

Decorator Design Pattern – Extending functionality with Decorator – Decorator in ABAP – Iterator Design Pattern – Programming on a Need-to-know basis – Iterator helps out – Iterator in ABAP – Template Method Design Pattern – Template Method in ABAP – Command Design Pattern – Null Object Pattern – State Design Pattern.

Textbooks:

1. Ranjit Kumar, "Research Methodology – a step-by-step guide for beginners", Sage Publications, Fifth Edition, 2019. (Unit I – Unit III)
2. James E.McDonough, "Object-Oriented Design with ABAP – A Practical Approach", Apress. 2017 (Unit IV – Unit V)

Reference Books:

1. C.R.Kothari,"ResearchMethodologyMethods&Techniques"2ndEdition,Wishwa Prakashan Publishers.
2. Dr.Rajammal P.Devadas, "A.Handbook on Methodology of Research-Sri Ramakrishna Mission Vidyalaya College of Rural Higher Education".

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**1**		**3**		**3**			**2**		**3**	**1**		**3**
CO2	**3**	**2**		**3**	**1**	**1**	**3**		**3**	**1**		**3**	**2**
CO3	**2**	**1**	**2**	**1**	**2**		**2**			**3**	**2**	**1**	**3**
CO4	**1**			**2**		**3**		**3**	**1**		**3**	**3**	
CO5		**3**	**1**		**3**	**2**	**1**				**2**		**2**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Advanced Computer Network	**4**	**5**	**5**	**0**	**Theory**

Introduction:
This aims to provide advanced background on relevant computer networking topics to have a comprehensive and deep knowledge in computer networks.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To learn about integrated and differentiated services in network architectures.
CO2	:	To understand the working of wireless network protocols.
CO3	:	To design the new protocols for modern networks.
CO4	:	To get familiarized with next generation networks.
CO5	:	To develop highly analytical and qualified IT engineers by imparting training on cutting edge technology professional ethics

Unit I: [12 Periods]
Introduction to Optical Networking – SONET/SDH Standards – Dense Wavelength Division Multiplexing (DWDM) – ATM: The WAN Protocol – Introducing ATM Technology – Introducing Faces to ATM – ATM / B-ISDN Reference Model – Physical Layer – ATM Layer – ATM Adaption Layer – ATM Cell Format – ATM QoS – ATM Bit Rate – ATM Traffic Management - Packet Switching Protocols.

Unit II: [12 Periods]
Protocols and Interfaces in Upper layers of TCP/IP – Introducing TCP/IP Suite – Explaining Network Layer Protocols – Explaining Transport Layer Protocols – Explaining Application Layer Protocols – Electronic Mail – Routing in the Internet – Routing – Unicast Routing Protocols – Multicast Routing Protocol.

Unit III: [12 Periods]
Other Routing Techniques –Introduction to Traffic Engineering – IP over ATM – Multiprotocol Label Switching – Storage Area Network – Network Management and Services – Introducing Network Management – network management Model – Network Management Architecture – Structure of Management Information (SMI) – Management Information Base (MIB) – SNMP - A Framework – SNMPv2 – SNMPv3.

Unit IV: [12 Periods]

Traffic Engineering Basics – Introducing Traffic Engineering – Requirement Definition for Traffic Engineering – Traffic Sizing – Traffic Characteristics – Protocols – Time and Delay Considerations – Connectivity – Availability, Reliability – Multimedia Over Internet – Multimedia Service Requirements – Multimedia Service Applications – Streaping Stored Audio/Video – Protocols for Real-Time Interactive Applications – RSVP – VOIP.

Unit V: [12 Periods]

Introduction to the CISCO IOS – Router Components – Cisco Router User Interface – Command Line Interface (CLI) – Router and Switch Administrative Function – Router Interfaces – Viewing and Saving Configurations – IP Routing – Dynamic Routing Protocols – Routing Protocols Basics – RIP – IGRP – Layer 2 Switching.

Textbooks:

1. Vilas S.Bagad, Iresh A.Dhotre, " Advance Computer Networks", Technical Publications, ISBN 9789350993026, (March 2019).

Reference Books:

1. James F. Kuros and Keith W. Ross, "Computer Networking: A Top-Down Approach", Pearson, 6th Edition, (2012).
2. Jeffrey S. Beasley and PiyasatNilkaew, "A Practical Guide to Advanced Networking" Pearson, 3rd Edition, (2012).
3. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", Prentice, 5th Edition, (2010).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**3**		**3**					**3**	**3**		**2**		
CO2	**1**	**3**			**2**		**3**	**2**	**1**	**3**		**2**	**1**
CO3	**2**	**2**		**3**		**1**	**1**		**2**	**3**	**1**	**3**	
CO4		**1**	**2**	**3**	**1**	**3**	**2**	**1**			**3**		**3**
CO5			**3**	**2**		**2**				**2**	**1**		

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Computer Network Lab	**4**	**0**	**0**	**4**	**Practical**

1. Configuration and logging to a CISCO Router and introduction to the basic user Interfaces. Introduction to the basic router configuration and basic commands.

2. Configuration of IP addressing for a given scenario for a given set of topologies.

3. Configure a DHCP Server to serve contiguous IP addresses to a pool of four IP devices with a default gateway and a default DNS address. Integrate the DHCP server with a BOOTP demon to automatically serve Windows and Linux OS Binaries based on client MAC address.

4. Configure, implement and debug the following: Use opensource tools for debugging and diagnostics. a. ARP/RARP protocols b. RIP routing protocols c. BGP routing d. OSPF routing protocols e. Static routes (check using netstat)

5. Configure DNS: Make a caching DNS client, and a DNS Proxy; implement reverse DNS and forward DNS, using TCP dump/Wireshark characterize traffic when the DNS server is up and when it is down.

6. Configure FTP Server on a Linux/Windows machine using a FTP client/SFTP client characterize file transfer rate for a cluster of small files 100k each and a video file of 700mb.Use a TFTP client and repeat the experiment.

7. Configure a mail server for IMAP/POP protocols and write a simple SMTP client in C/C++/Java client to send and receive mails.

8. Implement Open NMS+ SNMPD for checking Device status of devices in community MIB of a linux PC. Using yellow pages and NIS/NFS protocols implement Network Attached Storage Controller (NAS). Extend this to serve a windows client using SMB. Characterize the NAS traffic using wireshark.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**3**					**3**	**2**			**3**		**2**	**3**
CO2	**1**	**1**	**3**	**1**	**3**			**2**	**3**	**1**	**3**		
CO3		**2**	**1**			**2**	**3**	**3**				**1**	**2**
CO4	**3**	**3**	**2**	**3**				**2**	**2**	**1**		**3**	
CO5			**2**		**3**		**1**		**3**		**2**		

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	R Programming	**4**	**4**	**4**	**0**	**Theory**

Introduction:
R provides a wonderfully flexible programming environment favored by the many researchers who does some form of data analysis as part of their work. To learn to use R for your specific data analysis goals but also learn to think like a programmer.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	The fundamental syntax of R through readings, practice exercises, demonstrations, and writing R code
CO2	:	Critical programming language concepts such as control structures, functions and Exceptions
CO3	:	Able to appreciate and apply the R programming from a statistics and Probability.
CO4	:	Apply for Statistical testing and Modeling process
CO5	:	To Create a Plot Customization using Graphics

Unit I: [12 Periods]
The language: Getting Started – Numerics, Arithmetic, Assignment and Vectors – Matrices and Arrays – Non-Numeric Values – Lists and Data Frames – Special Values, Classes and Coercion – Basic Plotting –Reading and Writing Files.

Unit II: [12 Periods]
Programming: Calling Functions – Conditions and Loops – Writing Functions – Exceptions, Timings and Visibility.

Unit III: [12 Periods]
Statistics and Probability: Elementary Statistics – Basic Data Visualization – Probability – Common Probability Distributions.

Unit IV: [12 Periods]
Statistical Testing and Modeling: Sampling Distributions and Confidence – Hypothesis Testing – Analysis of Variance – Simple Linear Regression – Multiple Linear Regression – Linear Model Selection and Diagnostics.

Unit V: [12 Periods]

Advanced Graphics: Advanced Plot Customization – Going Further with the Grammar of Graphics – Defining Colors and Plotting in Higher Dimensions – Interactive 3D Plots.

Textbook:

1. Tilman M.Davies, "The Book of R: A First Course in Programming and Statistics", No Starch Press, First Edition, (2016).

Reference Books:

1. Torsten Hothorn, Brian S. Everitt, "A Handbook of Statistical Analyses using R", Third Edition, CRC Press, (2014).
2. Michael J. Crawley, "Statistics: An Introduction using R", Second edition, Wiley, (2015).
3. Hadley Wickham, "Advanced R", CRC Press, First Edition, (2015).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1			**3**			**3**	**3**	**2**	**1**	**3**	**1**		**3**
CO2	**2**	**1**		**2**	**3**					**1**	**1**	**3**	
CO3	**1**		**1**		**2**	**1**		**1**	**3**	**2**			**3**
CO4		**2**		**3**			**1**				**2**	**3**	
CO5	**3**		**3**		**2**	**3**			**2**		**3**		**1**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Big Data Analytics	**4**	**4**	**4**	**0**	**Theory**

Introduction:

This course helps to understand, and practice big data analytics and machine learning approaches, which include the study of modern computing big data technologies and scaling up machine learning techniques focusing on industry applications. Mainly the course objectives are: conceptualization and summarization of big data and machine learning, trivial data versus big data, big data computing technologies, machine learning techniques, and scaling up machine learning approaches.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Ability to understand the Big Data Platform and its Use cases
CO2	:	Provide an overview of Apache Spark
CO3	:	Provide Real-Time Concepts and Structured Streaming
CO4	:	Provide hands on Hodoop Eco System and Hivemalls
CO5	:	Access and Process Data on Graph Analytics with GraphX

Unit I: [12 Periods]

Big Data Analytics and the role of Hadoop and Spark – Big Data Science and the role of Hadoop and Spark – A typical Data Science Project Life Cycle – Tools and Techniques – Getting Started with Apache Hadoop and Apache Spark – Introducing Apache Hadoop – Introducing Apache Spark – Why Hadoop plus Spark.

Unit II: [12 Periods]

Deep Dive into Apache Spark – Starting Spark Daemons – Learning Spark core Concepts – Resilient Distributed Dataset – Spark Context – Lifecycle of Spark Program – Spark Applications – Persistence and Caching – Spark Resource Managers – Standalone, YARN and Mesos – Big Data Analytics with Spark SQL, DataFrames and Datasets.

Unit III: [12 Periods]

Real-Time Analytics with Spark Streaming and Structured Streaming – Introducing real-time Processing – Architecture of Spark Streaming – Spark Streaming transformations and actions – Input Sources and Output Stores – Spark Streaming with Kafka and HBase – Advanced Concepts of Spark Streaming – Monitoring Applications – Notebooks and Dataflows with Spark and Hadoop

Unit IV: [12 Periods]

Machine learning with Spark and Hadoop – Introducing Machine Learning – Machine Learning on Spark and Hadoop – Machine Learning Algorithms – An example of Machine Learning Algorithms – Building Machine Learning Pipelines – Machine Learning with H2O and Spark – Introducing Hivemall – Introducing Hivemall for Spark – Building Recommendation Systems with Spark and Mahout.

Unit V: [12 Periods]

Graph Analytics with GraphX – Introducing Graph Processing – Getting Started with GraphX – Transforming Graphs- GraphX Algorithms – Analyzing Flight Data Using GraphX – Introducing GraphFrames – Interactive Analytics with SparkR – introducing R and SparkR – Getting Started with SparkR – Using DataFrames with SparkR – Using SparkR with RStudio – machine Learning with SparkR – Using SparkR with Zeppelin.

Textbook:

1. Venkat Ankam, "Big Data Analytics", Packt, Kindle Edition, (2016).

Reference Books:

1. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)
2. Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.
3. Anand Rajaraman and Jef rey David Ulman, "Mining of Massive Datasets", Cambridge University Press, (2012).
4. ArvindSathi, "BigDataAnalytics: Disruptive Technologies for Changing the Game", MC Press, (2012).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**3**		**1**		**2**	**3**		**1**	**3**		**3**	**1**	**2**
CO2	**2**	**3**		**3**	**1**		**3**	**2**		**3**			
CO3	**1**	**2**	**3**	**1**		**1**	**3**	**1**	**1**		**2**	**3**	**3**
CO4		**3**			**3**		**1**	**2**		**3**	**1**	**3**	
CO5		**1**	**3**	**2**		**3**	**2**		**3**		**3**		**2**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Big Data Analytics Lab	**4**	**0**	**0**	**4**	**Practical**

1. Implement the followings in Java

i) Linked Lists ii) Stacks iii) Queues iv) Set v) Map

2. Perform setting up and Installing Hadoop in its three operating modes:

a) Standalone, Pseudo distributed, Fully distributed.

3. Implement the following file management tasks in Hadoop:

• Adding files and directories

• Retrieving files

• Deleting files Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.

4. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.

5. Write a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record-oriented.

6. Implement Matrix Multiplications with Hadoop Map Reduce.

7. Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.

8. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes.

9. Solve some real life big data problems.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**3**		**3**		**2**	**2**		**3**		**3**		**1**	
CO2	**2**	**2**		**3**			**3**	**2**			**1**		**3**
CO3		**1**			**1**		**1**		**3**	**1**	**2**	**2**	
CO4	**1**		**3**			**3**	**2**	**1**		**3**			**3**
CO5	**2**	**3**		**1**	**2**		**3**		**1**		**3**	**3**	**1**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Cryptography & Network Security	**4**	**4**	**4**	**0**	**Theory**

Introduction:
This Course focuses towards the introduction of network security using various cryptographic algorithms. Underlying network security applications. It also focuses on the practical applications that have been implemented and are in use to provide email and web security.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To understand basics of Cryptography and Network Security
CO2	:	To be able to secure a message over insecure channel by various means
CO3	:	To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
CO4	:	To understand various protocols for network security to protect against the threats in the networks
CO5	:	Be able to configure simple firewall architectures

Unit I: [12 Periods]
Computer and Network Security Concepts – Computer Security Concepts – Fundamental security design principles – Introduction to Number Theory – Classical Encryption Techniques – Block Ciphers and the Data Encryption standard.

Unit II: [12 Periods]
Finite Fields – Finite fields of the form - Advanced Encryption Standard – Block Cipher Operation – Multiple Encryption and Triple DES – Electronic Codebook – Random Bit Generation and Stream Ciphers – RC4.

Unit III: [12 Periods]
Public-Key Cryptography and RSA – The RSA Algorithm – Other Public-Key Cryptosystems – Diffie-Hellman Key Exchange - Cryptographic Hash Functions – Applications of Cryptographic Hash Functions - Message Authentication Codes.

Unit IV: [12 Periods]
Digital Signatures – Elgamal Digital Signature Scheme - Key Management and Distribution – Public-Key Infrastructure – User Authentication – Remote User-Authentication Principles – Network Access Control and Cloud Security.

Unit V: [12 Periods]

Transport-Level Security – Web Security Considerations – Wireless Network Security – IEEE 802.11 Wireless LAN Overview – Electronic Mail Security – Pretty Good Privacy – DNSSEC - IP Security – Cryptographic Suites.

Textbook:

1. William Stallings, "Cryptography and Network Security – Principles and Practice", Eight Edition, Global Edition, Pearson Education, (2020).

Reference Book:

1. Wenbo Mao, " Modern Cryptography: Theory and Practice", Prentice Hall PTR.
2. William Stallings, "Network Security Essentials: Applications and Standards", Prentice Hall
3. Douglas R. Stinson, "Cryptography: Theory and Practice", CRC press.
4. C.K. Shyamala, N Harini, Dr T R Padmanabhan, "Cryptography and Network Security", Wiley India, 1st Edition.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**1**			**1**	**2**		**2**	**1**	**1**	**1**		**2**	
CO2		**1**	**3**	**2**		**3**			**2**		**3**	**2**	**1**
CO3	**3**		**3**	**1**	**1**		**2**	**3**		**3**			**3**
CO4	**2**		**2**				**1**		**3**		**1**		
CO5		**3**		**3**		**1**		**2**		**2**	**2**	**3**	

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Network Security Lab	**4**	**0**	**0**	**4**	**Practical**

1. Write a C program that contains a string (char pointer) with a 1 value \Hello World'. The program should XOR each character in this string with 0 and displays the result.
2. Write a C program that contains a string (char pointer) with a 2 value \Hello World'. The program should AND or and XOR each character in this string with 127 and display the result.
3. Write a Java program to perform encryption and decryption 3 using the following algorithms:
    a) Ceaser Cipher
    b) Substitution Cipher
    c) Hill Cipher
4. Write a Java program to implement the DES algorithm logic
5. Write a C/JAVA program to implement the BlowFish algorithm logic
6. Write a C/JAVA program to implement the Rijndael algorithm logic.
7. Using Java Cryptography, encrypt the text "Hello world" usingBlowFish. Create your own key using Java keytool.
8. Write a Java program to implement RSA Algoithm
9. Implement the Diffie-Hellman Key Exchange mechanism 9 using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (bob).
10. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.
11. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**3**	**3**		**2**		**3**		**1**			**2**		**3**
CO2	**2**		**3**		**3**		**3**			**3**	**1**	**3**	
CO3		**3**	**2**	**2**	**1**	**1**		**2**	**1**		**3**	**1**	**2**
CO4	**3**					**2**				**2**			**1**
CO5	**2**	**3**		**3**	**2**		**1**		**3**	**2**		**3**	

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Cyber Law & Ethical Hacking	**4**	**5**	**5**	**0**	**Theory**

Introduction:
To clearly understand the meaning of Cyber Crime, one should first understand the meaning of the term Crime and then the meaning of Cyber Crime. to explore the issue of ethical hacking from an unconventional and unique viewpoint, one that draws upon my own vast experience

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To the emergence of a new kind of crime called the Cyber Crime.
CO2	:	To conduct the initial phase of gathering information
CO3	:	Ethical hackers and crackers are described for detecting the services
CO4	:	To get more information through their active services.
CO5	:	To deliver a useful report for our client's top management

Unit I: [12 Periods]
Introduction – Classification of Cyber Crimes – Information Technology law: A Bird's Eye View – Legal Protection Against Cyber Crimes – Cyber Crime: Landmark Judgments in India – Cyber laws: Recent Trends – Conclusions and Recommendations.

Unit II: [12 Periods]
Introduction to Ethical Hacking – Phases of Hacking – Types of Hacking – Kacking Modalities – Additional Hacking Services – Proposal Development and Beginning of the audit – Reconnaissance or Footprinting.

Unit III: [12 Periods]
Scanning – Ping Sweepers – TCP-Ping Tools – Ports states – Scanning Techniques – Port scanner: NMAP – Vulnerability Analyzers – Vulnerability Analysis with OpenVAS – Defensive Measures -

Unit IV: [12 Periods]
Enumeration – NetBIOS and CIFS/SMB Protocols - Windows enumeration using commands and software tools - All-in-one enumeration tools – Enumeration Laboratories – Preventive Measures

Unit V: [12 Periods]
Exploitation or hacking – Hacking Mechanisms – Hacking Frameworks – Metasploit Framework – MSF Architecture - Writing the audit report without suffering a mental breakdown - Steps to facilitate documentation of an audit.

Textbook:

1. CS Mamta Binani, "Cyber Crime: Law and Practice", First India, (2016).
2. Karina Astudillo B., "Ethical Hacking 101: How to conduct professional pentestings" , First Edition, (2015). (Unit II to Unit V)

Reference Book:

1. Kimberly Graves, " CEH:Certified Ethical Kacker Study Guide", Wiley, (2010).
2. Rafay Baloch, "Ethical Hacking and Penetration Testing Guide", CRC Press, (2014).
3. Kevin Beaver, "Ethical Hacking for Dummies", Sixth Edition, Wiley, (2018).
4. Jon Erickson , "Hacking: The Art of Exploitation", Second Edition, Rogunix, (2007).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1		**3**	**2**	**1**	**3**		**2**		**2**		**3**		**1**
CO2	**1**		**3**		**3**	**2**		**3**		**3**	**1**	**2**	
CO3		**3**		**2**			**1**		**1**		**2**	**1**	**3**
CO4	**3**	**2**		**1**	**2**	**2**	**1**		**3**	**3**		**2**	
CO5	**2**		**3**			**3**		**2**		**1**			**3**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Block Chain Technology	**4**	**5**	**5**	**0**	**Theory**

Introduction:

This Block Chain Technology course has been designed to explain what the technology is and how it works at a high level. You will build an awareness of Block Chain Technology and how it can be used to process crypto currency transactions across an open and distributed ledger.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To understand what Blockchain is and why it is used
CO2	:	To be able to explain the different components involved within Blockchain
CO3	:	To know when and why you may want to use Blockchain within your environment
CO4	:	Learn security measures, and various types of services that allow people to trade and transact with Bitcoins
CO5	:	To Exploit applications of Blockchain in real world systems and Regulations

Unit I: [12 Periods]

Say you want a Revolution: The Trust Protocol – How this Worldwide Ledger works – A Rational Exuberance for the Blockchain – Achieving Trust and the Black box of Identity – A Plan for Prosperity - Promise and Peril of the New Platform – Bootstapping the future: Seven Design Principles of Blockchain Economy – The Seven Design Principles – Designing the Future.

UnitI II: [12 Periods]

Transformations: Reinventing Financial Services – The Golden Eight – The Bank App – Reputation – The Blockchain IPO – Re-architecting the Firm: The Core and the Edges – New Business Models: Making it Rain on the Blockchain – bAirbub versus Airbub – Global Computing: The Rise of Distributed Applications – The DApp Kings – The Big Seven – Hacking Your Future.

Unit III: [12 Periods]

The Ledger of Things: Animating the Physical world – The Evolution of Computing – From Mainframes to Smart Pills – The Twelve Disruptions – Animating Things – The Economic Payoff – The Future: From Uber to Suber – Solving the Prosperity Paradox: Economic Inclusion and Entrepreneurship – Road Map to prosperity – Remittances – The story of Analie Domingo.

Unit IV: [12 Periods]

Rebuilding Government and Democracy – High-Performance Government Services and Operations – Empoering People to serve selves and others – Blockchain Voting – Alternative Models of Politics and Justice – Wielding Tools of Twent-first-century Democracy – Freeing Culture on the Blockchain – Music to Era – Fair Trade Music – Getting the Word Out.

Unit V: [12 Periods]

Promise and Peril: Overcoming Showstoppers – Ten Implementation Challenges – Reasons Blockchain will Fail or Implementation Challenges – Leadership for the Next Era – The Blockchain Ecosystem – A Cautionary Tale of Blockchain Regulation – The Senator Who would change the world – Central Banks in a Decentralized economy – Regulation Versus Governance.

Textbook:

1. Dan Tapscott and Alex Tapscott, "Blockchain Revolution", portfolio / Penguin trade paperback edition, (2018).

Reference Books:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, (2016).
2. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger," Yellow paper, (2014).
3. Josh Thompsons, "Blockchain for beginners guide to Blockchain technology and leveraging Blockchain Programming", Copyright, (2017).
4. Daniel Drescher, "Blockchain basics: A Non-Technical Introduction in 25 steps", Apress, (2017).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**1**		**3**			**3**		**3**		**3**	**3**		
CO2	**3**	**1**	**3**		**3**		**2**					**1**	
CO3				**3**		**2**		**3**	**3**	**2**	**1**	**3**	**3**
CO4	**3**		**2**		**2**		**3**				**2**		
CO5		**3**		**1**			**3**		**1**	**3**		**3**	**1**

Specializations Core

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Digital Forensics And Investigations	**4**	**4**	**4**	**0**	**Theory**

Introduction:

To understand how computer forensics is used as a powerful technique in digital investigation. To choose the process, various steps, tools and techniques involved in computer forensics. To appraise the need for understanding legal aspects of computer forensic investigation and need for meticulous documentation. To learn the various methods to investigate cybercrime. To learn about digital forensics and the laws acts behind.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Explain the importance of computer forensic in achieving the goals of information Security
CO2	:	Identify steps involved in recovering data stored in various devices and various techniques used in windows, Linux, network and web application forensics
CO3	:	Justify the need for meticulous documentation in computer forensics
CO4	:	Apply the rationale for having an adequate legal framework when dealing with computer forensics
CO5	:	Identify the kind of crime and create documentation.

Unit I: [09 Periods]

Computer Forensics:

Introduction to Computer Forensics, Forms of Cyber Crime, First Responder Procedure- Non-technical staff, Technical Staff, Forensics Expert and Computer Investigation procedure, Case Studies

UnitI II: [09 Periods]

Storage Devices & Data Recover Methods:

Storage Devices- Magnetic Medium, Non-magnetic medium and Optical Medium, Working of Storage Devices-Platter, Head assembly, spindle motor, Data Acquisition, Data deletion and data recovery method and techniques, volatile data analysis, Case Studies.

Unit III: [09 Periods]

Forensics Techniques:

Windows forensic, Linux Forensics, Network forensics – sources of network-based evidence, other basic technical fundamentals, Mobile Forensics – data extraction & analysis, Steganography, Password cracking-Brute force, Cross-drive analysis, Live analysis, deleted files, stochastic forensics, Dictionary attack, Rainbow attack, Email Tacking – Header option of SMTP, POP3, IMAP, examining browsers, Case Studies

Unit IV: [09 Periods]

Cyber Law:

Corporate espionage, digital evidences handling procedure, Chain of custody, Main features of Indian IT Act 2008 (Amendment), Case Studies, Incident specific procedures – virus and worm incidents, Hacker incidents, Social incidents, physical incident, Guidelines for writing forensic report.

Unit V: [09 Periods]

Forensic Analysis of Web Application:

Forensic analysis of web server, network analysis of web server compromise, web server log analysis, web application forensic, forensic analysis of web application security, intruder profiling, forensic for code injection attack, Case Studies.

Textbook:

1. "Computer Forensics: Computer Crime Scene Investigation" by John Vacca, Laxmi Publications, 1st; (2015).
2. "Digital Forensic: The Fascinating World of Digital Evidences" by Nilakshi Jain, et.al, Wiley, 1st ed; (2016).
3. "Windows Registry analysis" by Harlan Carvey, (2010).
4. The Art of Memory Forensics by Michael Hale Ligh, Andrew Case, Jamie Levy, Aron Walters.

Reference Books:

1. Malware Forensics Field Guide for Windows System , CameroH.Malin, Eoghan Casey, James M.Acuilina, Curtis W.Rose, Syngress, 2012 Books
2. The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics by John Sammons, Syngress, 2nd ed; 2014.
3. Cyber Forensics in India: A Legal Perspective by Nishesh Sharma, Universal Law Publishing – an imprint of LexisNexis; First 2017 edition.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**1**	**2**	**3**	**1**		**3**				**3**	**3**		**2**
CO2	**2**	**3**			**3**		**2**	**3**				**1**	
CO3				**2**		**1**		**1**	**3**	**2**	**1**	**3**	**3**
CO4		**1**	**2**		**3**		**1**				**2**		
CO5	**3**	**3**		**2**			**3**		**1**	**3**		**3**	**1**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Cyber Security Incident and Response Management	**4**	**3**	**3**	**0**	**Theory**

Introduction:

This Course focuses on the procedures for identification, preservation, and extraction of electronic evidence, auditing and investigation of network and host system intrusions, analysis and documentation of information gathered, and preparation of expert testimonial evidence. The course will also provide hands on experience on various forensic tools and resources for system administrators and information system security officers.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Understand the overview of incident response.
CO2	:	Able to Plan and prepare for all stages of an investigation - detection, initial response and management interaction
CO3	:	Analyse and Investigate web server attacks, DNS attacks and router attacks and also can learn the importance of evidence handling and storage
CO4	:	Able Monitor network traffic and detect illicit servers and covert channels
CO5	:	Understand the basics elements of network forensics

Unit I: **[09 Periods]**

Need for CSIRM

Differences between an event, incident and disaster, what are cyber security incidents, need for CSIRM, policy, plan and procedure, importance of communication protocol, key internal and external stakeholders, law enforcement, role of media, team structure and roles – important considerations

UnitI II: **[09 Periods]**

Handling a Cyber Security Incident

Incident response lifecycle, incident handling infrastructure and facilities requirements, detection and analysis, process, tools and techniques, attack vectors, recognizing signs of an incident, precursors, indicators and historical organization data, incident correlation, review of logs and vital system parameters, incident handling checklist, documentation and reporting

Unit III: **[09 Periods]**

Recovering from Cyber Security Incidents

Nature of incidents and the type of resources it affects, assessment of an incident's impact on business, IT operations and information, determining the amount of time and resources needed in recovering from an incident, prioritization, incident notification structure, containment, eradication and recovery – choosing a containment strategy.

Unit IV: **[09 Periods]**

Analysing from cyber security Incident

Evidence gathering and handling: examining the best security tools, evidence collection, analyzing the evidence and identifying the attack hosts. Eradication and recovery: extract live and dead data, analyzing the master boot record and volume boot record, post-incident analysis, evidence retention and lessons learned.

Unit V: **[09 Periods]**

Preventing Cyber Security Incidents

Incident analytics as input to proactive security measures to prevent incidents, risk assessment, host security, network security, malware prevention, user awareness and training, analysis of cost of control versus cost of incident impact, best practices, Flow chart of scenario questions, scenarios – DoS attack on DNS server, worm and DDoS agent infestation, military-classified documents stolen by an insider.

Textbook:

1. NIST SP 800-61r2 – "Computer Security Incident Handling Guide"
2. "Computer Incident Response and Product Security (Networking Technology: Security)" by Damir Rajnovic 1st, Kindle Edition
3. "Intelligence-Driven Incident Response: Outwitting the Adversary ", 1st Kindle Edition
4. "The Computer Incident Response Planning Handbook: Executable Plans for Protecting Information at Risk" by N.K. Mccarthy, Matthew Todd, Jeff Klaben, McGraw-Hill Education, (2012)

Reference Books:

1. "Incident Response & Computer Forensics", by Jason T. Luttgens, Matthew Pepe, Kevin Mandia, McGraw-Hill Education; 3rd edition, 2014
2. "Principles of Incident Response and Disaster Recovery", by Michael Whitman, Herbert Mattord Delmar Cengage Learning; 2nd Revised edition, 2013.
3. "Computer Incident Response and Forensics Team Management: Conducting a Successful Incident Response", by Leighton Johnson, Syngress, 2013

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3		3			3		2		1	3		
CO2	2	3	1		2		2					1	
CO3				3		2		3	3	2	1	3	3
CO4	1		2		3	1	3				2		
CO5		3		1			1		1	3		2	1

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Advanced Network Security	**4**	**4**	**4**	**0**	**Theory**

Introduction:
This Course aims to provide fundamental concepts and mechanisms for enforcing security in OS. Illustrate formal security goals and a variety of security models proposed for development of secure operating systems. Analyze variety of approaches applied to the development & extension services for securing operating systems

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Explain the fundamental concepts and mechanisms for enforcing security in OS.
CO2	:	Become knowledgeable in the concepts of various function in OS.
CO3	:	Gain hands-on experience in basic administration of a Linux system.
CO4	:	Interpret architectures of various security kernels to secure commercial OS.
CO5	:	Understand the concepts of securing operating system

Unit I: **[09 Periods]**
Threat classification, Principles of Secure Network Design – Defence in depth, least privilege, data protection, accountability and authentication

Unit II: **[09Periods]**
Introduction to Firewall, Various types of Firewall. DMZ, Security Policy components, Network Security Testing Tools and Techniques, Network scanning and Vulnerability analysis

Unit III: **[09 Periods]**
Checkpoint GAIA OS installation, configuration of network administrator, Configuring Internal and Externals network IP, Access Control, Authentication , Configuring Network Address Translation (NAT)

Unit IV: **[09 Periods]**
Anti-virus and URL filtering, Securing VoIP, Protocol Specific Security and Content Security

Unit V: **[09 Periods]**

User Identity and Access Management - Account Authorization, Access and Privilege Management, System and Network Access Control. Operating Systems Access Controls, Monitoring Systems Access Controls, Intrusion Detection System, Event logging, Cryptography. Physical Security: Identify Assets to be Protected, Perimeter Security, Firewalls, Prevention and Detection Systems, Safe Disposal of Physical Assets. Email Security: PGP, MIME, IP Security: IP security overview, Case study.

Textbook & Reference Books:

1. William Stalling, Operating System: Internals and Design Principles, Prentice Hall, 7th Edition, (2012).
2. Network security hacks By Andrew Lockhart, O'Reilly Media; Second Edition edition (November 6, 2006).
3. Checkpoint Next Generation Security Administration By Drew Simonis, Daniel Kligerman, Corey Pincock, (2010).
4. Promod Chandra P Bhat, An Introduction to Operating Systems: Concepts and practice, Prentice hall of India, 4th Edition, (2014).
5. Randal E. Bryant and David R. O'Hallaron, Computer Systems: A Programmer's Perspective, prentice Hall, 2nd Edition, (2011).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	1		1			3		3		1	3		
CO2	3	2	3		3		1					1	
CO3				3		2		3	3	2	1	3	3
CO4	3		2		3		1				2		
CO5		3		1			3		1	3		3	1

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Advanced Network Security Lab	**4**	**0**	**0**	**4**	**Practical**

List of Experiments:

1. Study of the features of firewall in providing network security and to set Firewall Security in windows.
2. Understanding network commands
3. Intrusion Detection System
4. Writing your own shell interpreter
5. Setup a honey pot and monitor the honeypot on network (KF Sensor)
6. Perform wireless audit on an access point or a router and decrypt WEP and WPA. (Net Stumbler)
7. Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (GnuPG)
8. Programs using network packet tracer
9. Eavesdropping attacks and its prevention using SSH.
10. VPN over WAN

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	1		1		2	3		3	2	1	3		3
CO2	3	2	3		1		2					1	
CO3				1		2		3	3	2	2	3	3
CO4	2		2		3		1				1		
CO5		3		3			3		1	3		2	1

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Python Programming	**4**	**3**	**3**	**0**	**Theory**

Introduction:
To setup the environment to run the python programs. To understand concepts about Data Types and Looping techniques. To understand and implement the OOP concepts, Decorators, and Iterators. To understand and build the Web Applications. Debugging and Troubleshooting Python Programs

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Write functions and Loops in the python program
CO2	:	Implementing OOPs concepts while writing Python Program
CO3	:	Developing web applications using Django
CO4	:	Build micro services in Python
CO5	:	Test, Debug and Troubleshoot Python Programs

Unit I: Introduction to Python **[09 Periods]**

Introduction: Introduction to Python, Setting up the environment, Installing Python, Running python program, Python's execution model, Guidelines on how to write good, The Python culture, A note on the IDEs

Built-in Data Types: Numbers, Immutable sequences, Mutable sequences, Set types, Mapping types – dictionaries, The collections module, Final considerations

Iterating and Making Decisions: Conditional programming, Looping, Putting this all together.

Unit II: Advanced Concepts **[09 Periods]**

Functions, the Building Blocks of Code: Use of functions, Scopes and name resolution, Input parameters, Return values, Recursive functions, Anonymous functions, Function attributes, Built-in functions, Importing objects.

Saving Time and Memory: map, zip, and filter, Comprehensions, Generators, Some performance considerations, Name localization, and Generation behavior in built-ins.

Advanced Concepts – OOP, Decorators, and Iterators: Decorators, Class and object namespaces, Attribute shadowing, Initializing an instance, Accessing a base class, Multiple inheritance, Static and class methods, Private methods and name mangling, The property decorator, Operator overloading, Polymorphism

Unit III: Web Development [09 Periods]

The Edges – GUIs and Scripts: Scripting-The imports, Parsing Arguments, The business logic, GUI application- The import, The layout logic, The business logic, The tkinter.tixmodule, The turtle module, wxPython, PyQt, and PyGTK, The principle of least astonishment, Threading considerations.

Web Development Done Right: Django design philosophy, The Django URL dispatcher, Setting up Django, Adding the Entry model, Customizing the admin panel, Creating the form, Writing the views, Tying up URLs and views, Writing the templates, Writing a Flask view, Building a JSON quote server in Falcon.

Unit IV: Cloud Native Python [09 Periods]

Building Microservices in Python: Modeling microservices, Building microservices, Testing the RESTful API.

Building a Web Application in Python: Getting started with applications, Working with Observables and AJAX, Binding data for the adduser template, Working on Observables with AJAX for the addtweettemplate, Data binding for the addtweet template, CORS - Cross-Origin Resource Sharing, Session management, Cookies.

Interacting Data Services: MongoDB terminology, Initializing the MongoDB database, Integrating microservices with MongoDB, Working with user resources, Working with the tweets resources.

Unit V: Exception Handling [09 Periods]

Testing, Profiling, and Dealing with Exceptions: The anatomy of a test, Testing guidelines, Unit testing, Test-driven development, Exceptions, Profiling Python.

Debugging and Troubleshooting: Debugging with print, Debugging with a custom function, Inspecting the traceback, Using the Python debugger, Inspecting log files, Other techniques, Troubleshooting guidelines.

TEXT BOOKS:

1. "Python for Data Science for Dummies" - Luca Massaron and John Paul Mueller, John Wiley & Sons, Inc.
2. "Learn Python Programming", 2nd Edition by Fabrizio Romano
3. "Python Cookbook", 3rd Edition by David Beazley (Author), Brian K. Jones (Author)

REFERENCES:

1. "Python for Data Analysis" - Wes McKinney, O'Reilly Media, Inc.
2. "Data Science from Scratch" - Joel Grus, O'Reilly Media, Inc.
3. "Python Scripting for Computational Science "- Hans PetterLangtangen
4. "Python and AWS Cookbook: Managing Your Cloud with Python and Boto" by Mitch Garnaat
5. "Advanced Python Programming: Build high performance, concurrent, and multi-threaded apps with Python using proven design patterns" by Dr. Gabriele Lanaro

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**3**		**3**			**3**		**3**	**2**	**1**	**3**		**2**
CO2	**2**		**1**		**2**		**2**					**1**	
CO3		**3**		**3**		**1**		**1**		**3**	**1**	**2**	**3**
CO4	**1**		**2**		**1**						**2**		
CO5		**1**		**1**			**2**		**1**	**3**		**3**	**1**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Python Programming Lab	**4**	**0**	**0**	**5**	**Practical**

List of Experiments:

1. Write a python program to find biggest number among four numbers using if-else
2. Write a python program to find given number is prime or not
3. Write a python program to find given number is palindrome or not
4. Write a python program to print multiplication table of given number
5. Write a python program to find mean of a n numbers using list
6. Write a python program to find given number is exist or not in the list, if exists print all its places
7. Write a python program to return sum of n numbers from a function using list
8. Write a python program to manipulate student details using dictionary and lists
9. Write a python program to return student details from a function using list and sno as parameter
10. Write a python program to manipulate employee details using classes and objects
11. Write a python program to read and write student details from and to a file using IO.
12. Write a python program to read content from student.csv file and find total number of students, maximum and minimum marks.

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	IT Governance, Risk, Compliance and Information Security Management	**4**	**3**	**3**	**0**	**Theory**

Introduction:
This course aims to introduce the basics of Information Risk and the knowledge in collecting data about organization. To do various analysis on Information Risk Assessment and to understand IT audit and its activities.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Explain how security is integrated with IT governance.
CO2	:	Justify the need for using standard frameworks in establishing a robust information security and risk management
CO3	:	Discover various Strategic planning ideas for IT
CO4	:	Elaborate risk management process
CO5	:	Compare various security frameworks

Unit I: IT Governance- Part 1: [09 Periods]
Introduction and Concepts, Origin of Governance, Corporate Governance, Best Practices for IT Governance, Role of Governance in Information Security, Six outcomes of effective Security Governance, benefits of good governance, Cultural aspects in governance

Unit II: IT Governance- Part 2: [09 Periods]
IT Governance, Roles and Responsibilities, Role of IT Strategy Committee and Security Steering Committee, Standard IT Balanced Scorecard. Val,IT framework of ISACA, Governance in multidepartment and multicounty enterprises, Importance of Governance in establishing a sustainable Security Culture in the organization

Unit III: Information Systems Strategy: [09 Periods]
Role of Strategic Planning for IT, Strategic Direction and Alignment of Security Strategy with Business Objectives, Role of CISO, Security Metrics Program

Unit IV: Risk Management Program: [09 Periods]
Develop a Risk Management Program. Risk Management Process, Roles and Responsibilities, Risk, IT Framework of ISACA, Strategic Security decisioning using Risk Management

Unit V: Information Security Management: [09 Periods]

Introduction, Performance Optimization, Management Information Security Forum, Segregation of Duties, Description of COBIT and other Frameworks, Security Program Effectiveness, Continuous Assessment and Improvement, Insourcing versus Outsourcing, Impact of ISM program across organization

TEXT BOOKS:

1. Information Security Governance by S.H. Solms, RossouwSolms, Springer; 1st Edition. 2nd Printing, 2008 edition (12 December 2008)
2. IT Governance: How Top Performers Manage IT Decision Rights for Superior Results by Weill, Harvard Business Review Press; First edition (1 June 2004)

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**1**	**3**		**1**	**2**		**2**				**2**	**3**	
CO2			**2**	**3**		**3**	**1**		**2**	**1**			**1**
CO3	**2**	**1**			**2**			**3**			**3**	**1**	
CO4			**1**	**2**	**3**		**3**		**1**	**3**			
CO5	**3**	**2**	**3**			**1**		**2**			**1**	**2**	**3**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Server-Side Scripting	**4**	**4**	**4**	**0**	**Theory**

Introduction:

To learn the server-side scripting languages and their applications. To understand complementarity of the class of languages to systems languages, their strengths and weaknesses. To learn Frameworks and CMS. To get knowledge about server-side scripting language python and ruby. Regular expressions, text processing, client, and server, level scripting and CGI, GUI programming using Python. Basic concepts: scripts and scripting, scripting versus programming, scriptable objects and component ware, Ajax.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Explain basic Server web architecture
CO2	:	Understand the working of python and its libraries
CO3	:	Make use of CGI and GUI in python language
CO4	:	Elaborate MVC Architecture and its use in Ruby.
CO5	:	Understand and use advance rails application

Unit I: Introduction to Server-side Scripting Languages [09 Periods]

Server-side Scripting, Different Scripting Languages, Web services, Web application frameworks – MVC, General purpose frameworks – e.g., Django, RoR; Discussion forums, Wikis, Weblogs, Content management system (CMS).

Unit II: Introduction to Python [09 Periods]

How to set up the environment, Lexical conventions and Syntax, Variables, Data Types, Operators, Statements and Expressions, Decision making, Loops, Strings, Tuples, Lists, Dictionary, Recursion, Date and Time, Functions, Modules – math, random; Files I/O, Exceptions

Unit III: CGI and GUI Programming in Python [09 Periods]

Classes and Objects, Regular Expressions, CGI Programming, Database Access Networking, Sending Email, Multithreading, XML Processing, GUI Programming, Extending and Embedding Python.

Unit IV: Introduction to Ruby on Rails [09 Periods]

MVC Architecture, how to install, Framework, Directory structure, Features, Basic Rails Application

Unit V: Advanced Rails Applications [09 Periods]

Setting up the database, Active records, Migrations, Controllers, Routes, Views, Layouts, Scaffolding, AJAX, uploading files, sending Email

TEXT BOOKS:

1. Python: Essential Reference, by David M. Beazley
2. Core Python Programming, by Wesley J. Chun, Prentice Hall
3. Python Programming: An Introduction to Computer Science, by John M. Zelle, Franklin – Beedle and Associates

REFERENCES:

1. Professional Ruby on Rails by Noel Rappin, Wiley India Pvt Ltd
2. Learn Ruby on Rails: Book one, by Daniel Kehoe

E-RESOURCES:

1. http://samples.jbpub.com/9781284056945/DBICHAP8.pdf

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**1**		**3**			**3**		**1**	**3**	**1**	**3**		**2**
CO2		**1**	**2**		**1**		**2**		**2**		**2**	**1**	
CO3		**3**		**3**		**2**		**2**		**2**	**1**		**3**
CO4	**2**		**1**		**2**		**3**				**2**	**2**	
CO5		**2**		**1**	**3**				**1**	**3**		**3**	**1**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Server - Side Scripting Lab	**4**	**4**	**4**	**0**	**Practical**

List of Experiments:

1. Write Python script to print prime number form m to n. where m<n
2. Write Python script to create "Book" class with properties "id", "author" and "price". Create 4 Book objects and print details of books on console
3. Write Python script to list files and their sizes from a directory
4. Write Python script for performing simple mathematical calculations using GUI.
5. Write python script to generate Login Screen(GUI) and perform authentication using "client" and "server" as username and password respectively
6. Write Python script to create "Student" table with columns "sno", "sname" and "result" in MySQL server and insert minimum 3 records into the table and print them all on console
7. Write Python script for simple chat application using networking
8. Design and Develop Ruby on Rails web application, which contains a welcome screen and displays the welcome message to the user with his name after entering name using Request and Response objects.
9. Design and Develop Ruby on Rails web application to manipulate Book details using MySQL database. Web pages as follows
10. Add book details screen/page

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**1**		**1**			**3**		**1**	**3**	**1**	**3**		**2**
CO2	**3**	**2**	**3**		**1**		**2**					**1**	
CO3				**3**		**1**			**2**	**3**	**1**	**2**	**3**
CO4	**2**		**2**		**3**		**1**	**2**			**2**		
CO5		**3**		**1**			**3**		**1**	**2**		**3**	**1**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Linux Security And Forensics	**4**	**3**	**4**	**0**	**Theory**

Introduction:

To introduce the basics of linux security and associated terminologies. To understand the types on communications on data networks. To gain knowledge of wireless frequency bands and related wireless attacks. To explore the knowledge of interpreting various web based attacks. To simulate the concepts on netfilter and perform live acquisition process.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Understand the basics of Linux Security
CO2	:	Illustrate the various data network security attacks
CO3	:	Explore different wireless attacks
CO4	:	Demonstrate the various web application attacks
CO5	:	Elaborate the process of live acquisition and evidence handling process

Unit I: Introduction To Linux Security [09 Periods]

Comprehensive Constraints, Elements of Security, Interactive Controls, Process Controls, Local Access Control-Console Access, Privilege Escalation, File Permissions and Attributes, Volatile Data.

Unit II: Data Networks Security [09 Periods]

Network Visibility, Systems Profiling, Network Architecture, Covert Communications and Clandestine Administration; Voice over IP-VoIP Attack Taxonomy Network Attacks, System Attacks, Signalling Attacks, Transport Attacks.

Unit III: Wireless Attacks [09 Periods]

Wireless Networks-The State of the Wireless, Wireless Hacking Physics, RF Spectrum Analysis, Exploiting 802.11, The Hacker Way, Wireless Auditing Activities and Procedures, Bluetooth Profiles, Entities on the Bluetooth Protocol Stack.

Unit IV: Web Application Hacking [09 Periods]

Enumeration, Access and Controls Exploitation, Insufficient Data Validation, Web 2.0 Attacks, Trust Manipulation, Man-in-the-Middle, Web Infrastructure Attacks, Mail Services-SMTP Basics, SMTP Attack Taxonomy, Alteration of Data or Integrity, Denial of Service or Availability

Unit V: Net Filter **[09 Periods]**

NetFilter Enhancements, Enhanced Wireless Stack, File System Enhancement, Additional Kernel Resources, The Forensic Workstation, Live Investigation/Acquisition, Post Mortem Analysis, Handling Electronic Evidence

TEXT BOOKS:

1. UNIX and Linux Forensic Analysis DVD Toolkit Chris Pogue, Cory Altheide, Todd Haverkos

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**2**		**1**			**3**		**3**	**2**	**1**		**2**	
CO2		**3**	**3**		**1**		**2**	**1**				**1**	**2**
CO3				**2**		**2**			**3**	**2**	**1**		**3**
CO4	**1**		**2**		**3**		**3**	**2**			**2**		
CO5	**3**	**2**		**1**		**1**			**1**	**3**		**3**	**1**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Linux Security And Forensics Lab	**4**	**0**	**0**	**4**	**Practical**

List of Experiments:

1. Write Python script to print prime number form m to n. where m<n
2. Write Python script to create "Book" class with properties "id", "author" and "price". Create 4 Book objects and print details of books on console
3. Write Python script to list files and their sizes from a directory
4. Write Python script for performing simple mathematical calculations using GUI.
5. Write python script to generate Login Screen(GUI) and perform authentication using "client" and "server" as username and password respectively
6. Write Python script to create "Student" table with columns "sno", "sname" and "result" in MySQL server and insert minimum 3 records into the table and print them all on console
7. Write Python script for simple chat application using networking
8. Design and Develop Ruby on Rails web application, which contains a welcome screen and displays the welcome message to the user with his name after entering name using Request and Response objects.
9. Design and Develop Ruby on Rails web application to manipulate Book details using MySQL database. Web pages as follows
10. Add book details screen/page

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**1**		**1**			**3**		**3**		**1**	**3**		**1**
CO2	**2**	**2**	**3**		**1**		**1**					**1**	
CO3				**2**		**2**		**3**	**3**	**2**	**2**	**3**	**3**
CO4	**3**		**2**		**3**		**2**				**1**		
CO5		**1**		**1**		**1**	**3**		**1**	**3**		**2**	**1**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Advance Ethical Hacking	**4**	**3**	**3**	**0**	**Theory**

Introduction:
To deals with the conceptual and implementation of Trojans and backdoors. To explore the various techniques of session hijacking and related web server attacks. To demonstrate the various tools for wireless and android hacking.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Explain the working of Trojans and backdoors
CO2	:	Explore the various techniques of session hijacking
CO3	:	Demonstrate the various effects of web server hacking attacks
CO4	:	Illustrate the various tools for wireless hacking process
CO5	:	Application of the process of android hacking

Unit I: Trojans and backdoor [09 Periods]
Overview of Trojans, what information Trojan creator look for, common ports used by Trojan , system infection methodology using Trojans, different ways to penetrate Trojan into system, Trojan deployment mechanism, types of Trojan, Trojan detection techniques, analysis of Trojan, countermeasures.

Unit II: Session hijacking [09 Periods]
Overview of session hijacking: application level and network level session hijacking, key session hijacking techniques: brute force, stealing, calculating. Process involved in session hijacking: command line injection, session ID prediction, session desynchronization, sniff. TCP/IP hijacking, session hijacking tools, countermeasures

Unit III: Web server hacking [09 Periods]
Types of webserver, webserver architecture: IIS and apache webserver, webserver attacks, methodologies of webserver attack: misconfiguration of webserver, HTTP response splitting, and web cache poisoning, hijacking HTTP response, SSH brute force attack. Webserver attacks methodologies: gathering information, foot printing and mirroring websites. Webserver attack tools, Countermeasures.

Unit IV: Wireless network hacking [09 Periods]

Overview of wireless network, wireless encryption techniques, threads associated with wireless network, types of wireless network: extension to wired, multiple access point, LAN to LAN, 3G/4G hotspot. Wireless standards, process of authentication in wireless network, wireless hacking methodologies, wireless security tools an countermeasures.

Unit V: Android hacking [09 Periods]

Introduction to android, architecture of android operating system, mobile attack vectors, Existing vulnerabilities in android platform, android rooting, android rooting tools, android Trojans, exploiting android using msf-venom, android security guidelines and countermeasures

TEXT BOOKS:

1. Gray Hat Hacking The Ethical Hackers Handbook, 3rd Edition Paperback – 1 Jul 2017 by Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, McGraw Hill Education; 3 ed (1 July 2017)
2. CEH v9: Certified Ethical Hacker Version 9 Study Guide by Sean-Philip Oriyano, Sybex; Stg edition (17 June 2016)
3. Hacking for Beginners: Ultimate 7 Hour Hacking Course for Beginners. Learn Wireless Hacking, Basic Security, Penetration Testing by Anthony Reynolds, CreateSpace Independent Publishing Platform (10 April 2017)
4. An Ethical Guide To WI-FI Hacking and Security by Swaroop Yermalkar, BecomeShakespeare.com; First edition (15 August 2014)
5. Hands-On Ethical Hacking and Network Defense by Michael T. Simpson | Kent Backman | James Corley, Cengage India 1st edition (2016).

REFERENCES:

1. The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy by Patrick Engebretson, Syngress; 2 edition (12 September 2013)
2. Hacking With Python: The Complete Guide to Ethical Hacking, Basic Security, Botnet Attack,Python hacking and Penetration Testing Kindle Edition by John C. Smalls.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**3**				**1**			**3**	**2**		**3**		**2**
CO2		**2**	**3**		**3**		**2**			**1**		**1**	
CO3	**2**			**1**		**3**		**1**	**3**	**2**			**3**
CO4	**1**		**2**		**2**			**2**		**3**	**1**		
CO5		**3**		**3**		**1**	**3**		**1**	**3**	**2**	**3**	**1**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Advance Ethical Hacking Lab	**3**	**0**	**0**	**3**	**Practical**

List of Experiments:

1. Creating a Trojan.
2. TCP/IP hijacking
3. Performing web cache poisoning
4. Launching HTTP response splitting
5. Linux Hacking
6. Windows Hacking through DoS attack
7. Log collection from network devices
8. Identify the vulnerabilities on android phone.
9. Exploiting android using msf-venom
10. Wifi hacking

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**2**		**1**			**3**		**3**		**1**	**3**		**2**
CO2	**3**	**2**	**3**		**2**		**2**		**2**			**1**	
CO3		**1**		**3**		**2**		**1**		**2**	**1**	**3**	**3**
CO4	**1**		**1**		**3**		**1**		**3**		**2**		
CO5		**3**		**1**		**1**	**3**	**2**	**1**	**3**		**3**	**1**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Malware Analysis	**4**	**4**	**4**	**0**	**Theory**

Introduction:
To recognize the types of malware through analysis methods. To learn basic and advanced malware analysis techniques. To practice the android malware analysis techniques for real world applications

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Identify various malwares and understand the behaviour of malwares in real world applications
CO2	:	Implement different malware analysis techniques
CO3	:	Analyze the malware behaviour in windows and android
CO4	:	Understand the purpose of malware analysis
CO5	:	Identify the various tools for malware analysis

Unit I: Introduction [09 Periods]
Malware Analysis Goals of Malware Analysis, Techniques Static and Dynamic Analysis, Types of Malware Backdoor, Botnet, Downloader, Information Stealing malware, Launcher, Rootkit, Scareware, Worm or Virus.

Unit II: Data Collection Methods [09 Periods]
Volatile Data Collection Methodology-Preservation of Volatile Data, Physical Memory Acquisition on a Live Windows System, Identifying Users Logged into the System, Non-Volatile Data Collection Inspect Prefetch Files, Examine the File System, Remote Registry Analysis, Examine Web Browsing Activities, Examine Cookie Files.

Unit III: Windows Basics [09 Periods]
Introduction to Windows Malware - Windows Basics Relevant to Malware Behavior-File System and Directory structure, Registry, Boot Sequence, Malware payloads

Unit IV: Static and Dynamic Malware Analysis [09 Periods]
Static: Number System Static Analysis with File Attributes and PE Header Packet Identification
Dynamic: Malware activities, Self-Start techniques, Essential setup for executing malware, Executing DLL files, Classifying Malware Based on their Behavior.

Unit V: Android Malware Analysis [09 Periods]

APK File Structure Security Model Android Root Brief Description of Spreading and Distribution Introduction to Android Debugging Tools and Their Usage Dex Structure Parsing Basic Analysis of an APK. Exploits MasterKey VulnerabilityFileNameLength Vulnerability Introduction to Obfuscation DEX code obfuscation

TEXT BOOKS:

1. Cameron H. Malin, Eoghan Casey, James M. Aquilina and Curtis W. Rose, " Malware Forensics Field Guide for Windows Systems", Syngress, Elsevier, 2012
2. Christopher C. Elisan , "Advanced Malware Analysis", Tata McGraw Hill, 2015

REFERENCES:

1. Ken Dunham, Saeed Abu-Nimeh, Michael Becher and Seth Fogie, Mobile Malware Attacks and Defense, Syngress, Elsevier, 2009
2. John Aycock, Computer Viruses and Malware, Springer, 2006.
3. ErciFiliol, Computer Viruses: from theory to applications, Springer, 2005

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**1**		**1**	**2**		**3**	**1**	**3**		**1**	**3**		**2**
CO2	**3**	**2**	**3**		**1**							**2**	
CO3				**1**		**1**		**1**	**3**	**2**	**1**	**3**	**3**
CO4	**2**	**1**	**2**		**2**		**2**				**2**		
CO5		**3**		**3**		**2**	**3**		**1**	**3**		**1**	**1**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Malware Analysis Lab	**4**	**0**	**0**	**4**	**Practical**

List of Experiments:

1. Packet sniffing with Wire shark
2. Capturing intruders through packet inspection
3. Analysis of various Malware types and behavior
4. Basic Static Analysis
5. Basic Dynamic Analysis
6. Analyzing windows programs
7. Android malware analysis
8. Data encoding and malware countermeasures
9. Comparative study of various malware analysis tools
10. Tools available in Antivirus Application

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**1**		**1**			**3**		**1**		**1**	**3**		**1**
CO2	**3**	**2**	**3**		**1**		**2**		**2**			**2**	
CO3				**3**		**2**		**3**		**2**	**1**	**3**	**3**
CO4	**2**	**2**	**2**		**3**		**1**				**2**		
CO5		**1**	**2**	**1**		**3**	**3**		**1**	**3**		**1**	

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Server Security	**4**	**3**	**3**	**0**	**Theory**

Introduction:
Understand the concepts and the various techniques for setting up a secured platform based servers. Demonstrate the configuration process of secured web servers.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Understand the concepts of server security
CO2	:	Explore the various techniques of implementing a secure server.
CO3	:	Configuration of secure windows and Linux servers
CO4	:	Determine the concepts for implementing a secure SQL server
CO5	:	Configuring the web servers with security protocols

Unit I: Conceptual understanding on Server Security [09 Periods]
User authentication and authorization – limiting system access and controlling using behavior, restricting access to software, restricting software access to resources, controlling access to data, EFS basics, maintenance and recovery strategies, security risk assessment of servers – high, medium, low risk servers and applications and development of server security policy, important steps to improve security of servers, server security principles

Unit II: Techniques for Securing Server [09 Periods]
Implementing physical security, Server hardening – OS and hardware, important ports, services and protocols that improve server security, key steps to be followed while planning and deployment, user administration, password management, encryption, configuring logging, vulnerability scanning and penetration testing.

Unit III: Securing Windows and Linux Servers [09 Periods]
Windows server 2012 R2 OS and baseline security configuration, SCM, Active Directory, AppLocker and PowerShell, server types and roles, SMB configuration and encryption, baseline application security, BitLocker, network services security, auditing and monitoring, overview of Red Hat Enterprise Linux 6 server security, using TCP Wrappers, enhancing security with xinetd, securing portmap, NIS, NFS, FTP, Postfix, Sendmail, securing Apache HTTP server

Unit IV: Securing SQL Server [09 Periods]

Understanding threats to SQL server using STRIDE and DREAD methods, SQL server security model – security principal hierarchy, instance level security, logins, server roles, credentials, database level security, users and roles, data-level security – schemas, RLS, dynamic data masking, encryption in SQL server, securing metadata, important security configurations for DBAs, understanding MySQL server security

Unit V: Securing Web Server [09 Periods]

Securing Apache 2.4 webserver OS, configuring access controls, securing web content, authentication and encryption techniques, key security configurations in web server, tools and techniques used for web server security, using checklist for web server security assessment, securing Apache, Nginx server as reverse-proxy

TEXT BOOKS:

1. NIST's Guide to General Server Security Special Publication 800-123
2. CompTIA Server+ Study Guide by Troy McMillan, Sybex; Study Guide edition (26 July 2016)
3. Getting Started with Windows Server Security by Santosh Sivarajan, Packt Publishing Limited (27 February 2015)
4. Linux Server Security: Hack and Defend by Chris Binnie, Wiley (2016)
5. Red Hat Enterprise Linux 6 Security Guide
6. Practical Linux Security Cookbook by Tajinder Singh Kalsi, Packt Publishing Limited (29 April 2016)

REFERENCES:

1. Securing SQL Server: DBAs Defending the Database by Peter A. Carter, Apress; 1st ed. edition (19 November 2016)
2. NIST's Guidelines on Securing Public Web Servers SP 800-44 v2
3. A Web Developer's Guide to Securing a Server (Web Security Topics) by Nigel Chapman, Jenny Chapman, Macavon Media (22 November 2011)
4. Securing SQL Server: Protecting Your Database from Attackers by Denny Cherry, Syngress; 3 edition (24 April 2015)

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**3**		**3**			**1**		**1**		**1**	**3**	**2**	
CO2		**2**	**1**		**2**		**2**		**1**	**3**		**1**	
CO3	**2**			**3**		**2**		**2**	**3**	**2**	**1**		**3**
CO4	**1**		**2**		**3**		**3**	**1**			**2**		**2**
CO5		**3**		**1**		**2**	**1**	**3**	**1**	**3**		**3**	

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Cyber Forensics	**4**	**3**	**3**	**0**	**Theory**

Introduction:

To help students understand how computer forensics is used as a powerful technique in digital investigation. To understand the importance of file system in Windows and Linux machine for Forensics Investigation. To aware about the challenges associated with digital forensic comminute around the world. To make it possible for students to learn the process, various steps, tools and techniques involved in computer forensics. To facilitate students, appreciate the need for understanding legal aspects of computer forensic investigation and need for meticulous documentation

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Explain the basics of computer forensics
CO2	:	Apply a number of different computer forensic tools to a given scenario
CO3	:	Analyze and validate forensics data
CO4	:	Identify the vulnerabilities in a given network infrastructure.
CO5	:	Interpret real-world hacking techniques to test system security.

Unit I: Computer Forensics [09 Periods]

An overview of Digital Forensics, Preparing for Digital Investigations: Following Legal Processes, Understanding Private-Sector Investigations. Maintaining Professional Conduct, Preparing a Digital Forensics Investigation, Procedures for Private-Sector High-Tech Investigations, Understanding Data Recovery Workstations and Software, Conducting an Investigation

Unit II: Data acquisition and incident scenes [09 Periods]

Understanding Storage Formats for Digital Evidence, Validating Data Acquisitions: Linux validation and Windows validation method. Processing Crime and Incident Scenes, Understanding File Systems, Examining NTFS Disk, Understanding the Windows Registry, examining the windows swap file, Log analysis in windows forensic, Windows forensic tools

Unit III: Network and Cloud Forensic [09 Periods]

Network forensic overview, establishment procedure for network forensic, securing a network, developing procedure for network forensic, collecting network traffic data, examining and analyzing network traffic data, legal challenges in cloud forensic, technical challenges in cloud forensic, acquisition in cloud forensic, conducting cloud investigation.

Unit IV: Email and Social Media Forensic [09 Periods]

Exploring the role of email in investigation, exploring the role of client and server in email, investigating E-mail crimes and violations: examining E-Mail messages, Examining E-mail headers, examining additional email files, tracing an Email messages, Understanding Email server, Applying digital forensic to social media, E-mail case studies

Unit V: Forensic report writing and ethics for expert witness [09 Periods]

Understanding the importance of reports, guidelines for writing report, generating report using forensic software, Applying ethics and code to expert witness, organizations with code of ethics, Ethical Difficulties in Expert Testimony, An Ethics Exercise

Text Books and References:

1. John R. Vacca, Computer Forensics: Computer Crime Scene Investigation, Charles River Media, 2015, ISBN-10: 9788170083412, ISBN-13: 9788170083412
2. Guide to Computer Forensics and investigations, Fifth Edition, Bill Nelson, 2015 **(Paperback)**
3. Cyber Forensics: Second Edition by Jr., Albert Marcella, Doug Menendez **(Paperback)**

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**1**		**3**	**2**		**3**	**1**	**3**		**1**	**3**	**2**	
CO2	**3**	**1**			**1**		**2**		**2**	**2**		**1**	
CO3			**1**	**3**		**3**		**1**	**3**		**1**		**3**
CO4	**2**		**2**		**2**		**3**				**2**	**1**	
CO5		**3**		**1**		**2**		**2**	**1**	**2**		**3**	**1**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Cyber Laws	**4**	**3**	**3**	**0**	**Theory**

Introduction:
This course helps to understand the basics of cyber law and its related issues

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To explain the basic information on cyber security.
CO2	:	To understand the issues those are specific to amendment rights.
CO3	:	To have knowledge on copy right issues of software's.
CO4	:	To understand ethical laws of computer for different countries
CO5	:	To gain knowledge of different IT Act 2000 Laws and Regulations

Unit I: Introduction [09 Periods]
Introduction-Cyber Security and its problem-Intervention Strategies: Redundancy, Diversity and Autarchy.

Unit II: Regulations [09 Periods]
Private ordering solutions, Regulation and Jurisdiction for global Cyber security, Copy Right-source of risks, Pirates, Internet Infringement, Fair Use, postings, criminal liability, First Amendments, Data Losing.

Unit III: Copy Rights [09 Periods]
Copy Right-Source of risks, Pirates, Internet Infringement, Fair Use, postings, Criminal Liability, First Amendments, Losing Data, Trademarks, Defamation, PrivacyCommon Law Privacy, Constitutional law, Federal Statutes, Anonymity, Technology expanding privacy rights.

Unit IV: [09 Periods]
Duty of Care, Criminal Liability, Procedural issues, Electronic Contracts & Digital Signatures, Misappropriation of information, Civil Rights, Tax, Evidence.

Unit V: Maintaining the Policies [09 Periods]
Ethics, Legal Developments, Late 1990 to 2000, Cyber security in Society, Security in cyber laws case studies, General Law and Cyber Law-a Swift Analysis, Indian Cyber Laws and updations

TEXT BOOKS:

1. Jonathan Rosenoer, "Cyber Law: The law of the Internet", Springer-Verlag, 1997
2. Mark F Grady, FransescoParisi, "The Law and Economics of Cyber Security", Cambridge University Press, 2006

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**3**		**3**	**2**		**3**		**3**		**3**	**3**	**2**	
CO2		**2**	**1**		**1**		**2**		**2**			**1**	
CO3				**3**		**2**		**1**	**3**	**1**	**1**		**3**
CO4	**1**		**2**		**3**	**1**		**3**			**2**		
CO5		**3**		**1**			**3**	**2**	**1**	**2**		**3**	**1**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Information Security Policies in Industry	**4**	**3**	**3**	**0**	**Theory**

Introduction:
This course helps to understand how an organization frames its policies, standards, and practices using education, training and awareness programs.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Explain the content, need, and responsibilities of information security policies
CO2	:	Explain the standards, guidelines, Procedures, and key roles of the organization.
CO3	:	Devise policy document for securing network connection and interfaces.
CO4	:	Explain the threats to the stored data or data in transit and able to write policy document.
CO5	:	Devise, monitor, and review policy document.

Unit I: Introduction to Information Security Policies [09 Periods]
About policies, why policies are important, when policies should be developed, how policy should be developed, policy needs, identify what and from whom it is being protected, data security consideration, backups, archival storage and disposal of data, intellectual property rights and policies, incident response and forensics, management responsibilities, role of information security department, security management and law enforcement, security awareness training and support

Unit II: Policy Definitions and Network Security [09 Periods]
Policy definitions, standards, guidelines, procedures, writing the security policies, physical security, computer location and facility construction, facility access controls, contingency planning, general computer systems security, periodic system and network configuration audits, staffing consideration, authentication and network security, network addressing and architecture, access control, login security, passwords, user interface, access controls, telecommuting and remote access

Unit III: Writing the Security Policies [09 Periods]
Internet security policies, understanding the door to the internet, administrative and user responsibilities, WWW policies, application responsibilities, VPNs, extranets, intranets and other tunnels, modems and other backdoors, employing pki and other controls, electronic commerce E-mail security policies, rules for using email, administration of email, use of email for confidential communication Viruses, worms and Trojan horses: the need for protection, establishing type of viruses protection, rules for handling third party software, user involvement with viruses

Unit IV: Encryption and Software Development Policies [09 Periods]

Legal issues, managing encryption, handling encryption and encrypted data, key generation considerations, key management Software Development policies: software development processes, testing and documentation, revision control and configuration management, third party development, intellectual property issues

Unit V: Maintaining the Policies [09 Periods]

Writing the AUP, user login responsibilities, organization's responsibilities and disclosures, compliance and enforcement, testing and effectiveness of policies, publishing and notification requirements of the policies, monitoring, controls and remedies, administrator responsibility, login considerations, reporting of security problems, policy review process, the review committee, sample corporate policies, sample security policies

TEXT BOOKS:

1. Scott Barman, Writing Information Security Policies, Sams Publishing, 2002. ISBN-10: 157870264X. ISBN-13: 9781578702640
2. I. Niven, H.S. Zuckerman and H. L. Montgomery, An introduction to the theory of numbers, John Wiley and Sons, 2008. ISBN-10: 9788126518111. ISBN-13: 9788126518111

REFERENCES:

1. Thomas R Peltier, Justin Peltier, John Backley, Information Security Fundamentals, Auerbach publications, CRC Press, 2004. ISBN-10: 0849319579. ISBN-13: 9780849319570
2. Harold F. Tipton and Micki Krause, Information Security Management Handbook, Auerbach publications, 6th Edition, 2012. ISBN-10: 1439893136. ISBN-13: 978 1439893135

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**3**		**1**			**3**	**1**	**3**	**2**		**3**		**2**
CO2	**1**	**2**		**2**	**3**		**2**			**1**		**1**	
CO3			**3**	**3**		**1**		**1**	**3**	**2**		**3**	**3**
CO4		**1**	**2**		**2**		**3**				**2**		
CO5	**2**	**3**		**1**		**2**		**2**	**1**	**3**		**3**	**1**

List of Electives

Elective – I

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective I - Distributed Networks	**4**	**5**	**5**	**0**	**Theory**

Introduction:

The goal of a distributed network is to share resources, typically to accomplish a single or similar network. Usually, this takes place over a computer network, however, internet-based computing is rising in popularity. Typically, a distributed networking system is composed of processes, threads, agents, and distributed objects. A merely distributed physical component is not enough to suffice as a distributed network, typically distributed networking uses concurrent program execution.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To understand how to successfully incorporate them into distributed systems and services.
CO2	:	To support the distributed embedded systems with real-time systems
CO3	:	To include intrusion tackling and peer-to-peer traffic detection Future wireless networking scenarios
CO4	:	To include the use of software sensors instead of hardware sensor
CO5	:	To maintain their own distributed network under the traditional of Cloud computing model

Unit I: [12 Periods]

Distributed Network Intelligence and Systems: Cooperative Regression-based forecasting in Distributed Traffic Networks – A Sensor Data Aggregation system Using Mobile Agents – Underlay-Aware Distributed Service Discovery Architecture with Intelligent Message Routing.

Unit II: [12 Periods]

System-Level Performance Simulation of Distributed Embedded Systems via ABSOLUT – Self-Organizing Maps: The Hybrid SOM-NG Algorithm – A Semi-supervised and Active Learning Method for Alternatives.

Unit III: [12 Periods]

Distributed Network Security: Trackling Intruders in Wireless Mesh Networks – Semi-Supervised Learning NitTorrent Traffic Detection – Developing a Content Distribution System over a Secure Peer-to-Peer Middleware.

Unit IV: [12 Periods]

Applications and Trends in Distribution Enterprises: User Activity Recognition through Software Sensors – Multi-Agent Framework for Distributed Leasing-Based Injection Mould Remanufacturing – The Smart Operating Rooms: smartOR.

Unit V: [12 Periods]

Distributed Online Safety Monitor based on Multi-Agent System and AADL Safety assessment Model – State of the Art of Service-level Agreements in Cloud Computing – Used Products Return Service based on Ambient Recommender System to promote Sustainable Choices.

Textbook:

1. Qurban A.Memon, "Distributed networks – Intelligence, Security and Applications", CRC Press Taylor & Francis Group, (2017).

Reference Books:

1. Coulouris, Dollimore, Kindberg, Blair, "Distributed System: Concepts and Design", Fifth Edition, Pearson Ed.
2. A.D. Kshemkalyani, M. Singhal, "Distributed Computing: Principles, Algorithms, and Systems", ISBN: 9780521189842, Cambridge University Press, (2011).
3. Andrew S. Tanenbaum and Maarten Van Steen, "Distributed Systems: Principles and Paradigms", 2nd edition, Pearson Education, (2016).
4. M. L. Liu, Distributed Computing Principles and Applications, Pearson Addison Wesley, (2004).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**3**	**3**	**1**			**2**		**1**	**2**	**3**			**2**
CO2	**1**		**2**	**3**	**2**		**2**				**3**	**1**	
CO3		**1**		**2**	**2**	**3**			**1**	**1**	**2**	**2**	**3**
CO4	**2**			**1**	**3**		**1**	**3**		**2**			**3**
CO5		**2**	**3**			**1**	**3**	**2**	**3**		**1**	**3**	

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective I - Social Network Analytics	**4**	**5**	**5**	**0**	**Theory**

Introduction:
This course will enable students to grasp the analytics tools to leverage social media data. The course will introduce tools such as engagement analytics, sentiment analysis, topic modeling, and social network analysis, identification of influencers and evaluation of social media strategy. It will involve lots of hands-on exercises.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To Know basic notation and terminology used in network science
CO2	:	To Understand and apply key concepts in social media metrics using Graph
CO3	:	To Understand basic principles behind Clusters and components algorithms
CO4	:	To be capable of analyzing mode of networks in real world
CO5	:	To be capable of analyzing real world networks using Big Data

Unit I: [12 Periods]
Introduction: Analyzing Relationships to Understand People and Groups – From Relationships to Networks – More than Meets the Eye – Social Networks Vs. Link Analysis – The power of Informal networks – Terrorists and Revolutionaries: The Power of Social Networks

Unit II: [12 Periods]
Graph Theory – A quick Introduction – What is a Graph? – Graph Traversals and Distances – Graph Distance – Why this Matters – 6 Degrees of Separation is a Myth – Small World Networks – Centality, Power and Bottlenecks.

Unit III: [12 Periods]
Cliques, Clusters and Components – Components and Subgraphs – Subgraphs – Ego Networks – Triads – Cliques – Hierarchical Clustering – Traids, Network Density and Conflict.

Unit IV: [12 Periods]
2-Mode Networks – Does Campaign Finance Influence Elections – Theory of 2-Mode Networks – Expanding Multimode Networks – Going Viral! Information Diffusion – Anatomy of a Viral Video – How Does Information Shape Networks – A Simple Dynamic Model in Python

Unit V: [12 Periods]

Graph Data in the Real World – Medium Data; The Tradition – Big Data: The Future, Starting Today – "Small Data"– Flat File Representations – "Medium Data"-Database Representation – Working with 2-Mode Data – Social Networks and Big Data – Big Data at Work.

Textbook:

1. Makism Tsvetovat & Alexander Kouznetsov, "Social Network Analysis for Startups", O'Reilly Media, Inc., (2011).

Reference Books:

1. Reza Zafarani, Mohammed Ali Abbasi, Huan Liu., "Social Media Mining: An introduction". Cambridge University Press, (2014).
2. Eric Kolaczyk, Gabor Csardi. "Statistical Analysis of Network Data with R (Use R!)". Springer, (2014).
3. Maarten van Steen, "Graph Theory and Complex Networks. An Introduction", (2010).
4. Jared Lander, "R for Everyone: Advanced Analytics and Graphics", Addison-Wesley, (2013).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1		**2**	**1**	**3**			**1**	**3**	**1**	**3**		**1**	**3**
CO2	**3**				**3**	**2**	**3**	**2**		**2**	**3**	**2**	
CO3	**2**		**1**	**2**		**3**			**3**		**2**	**3**	**2**
CO4	**1**	**2**					**2**		**2**	**1**	**2**		**3**
CO5		**3**	**2**	**1**	**3**	**1**		**1**			**1**	**3**	

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective –I Computer Graphics and Multimedia	**4**	**5**	**5**	**0**	**Theory**

Introduction:
To develop an understanding and awareness of computer graphics how issues such as content, information architecture, motion, sound, design, and technology merge to form effective and compelling interactive experiences for a wide range of audiences and end users. To become familiar with various software programs used in the creation and implementation of multimedia.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To understand the structure of an interactive computer graphics system, and the separation of system components.
CO2	:	To understand the two-dimensional graphics and their transformations.
CO3	:	To understand of techniques for representing 3D geometrical objects and 3D Viewing
CO4	:	To appreciate illumination and color models for animation
CO5	:	To Create time-based and interactive multimedia components

Unit I: [12 Periods]
Introduction to Computer Graphics – History and Evolution – Survey of Computer Graphics – Graphics Hardware and Software – Overview of Graphics Systems – GKS Programs – Opengl Programs – Vrml Programs – Graphics Primitives – Basic Concepts – Line Drawing Algorithms – Loading the Frame Buffer – Line Function – Circle drawing Algorithms – Bresenham's Midpoint Ellipse Algorithm – Polygon-Fill Algorithms – OpenGL Algorithm.

Unit II: [12 Periods]
Two-Dimensional Transformation – Transformation – Basic Transformations – Composite Transformations – Other Transformations – Rigid body and Affine Transformations – Properties of Transformation – OpenGL Programs – Two-Dimensional Viewing and Clipping – Viewing Pipeline – Interior Clipping – OpenGL Programs – Graphical User Interfaces and Interactive Input devices – User Dialogue – Interactive Picture Construction Techniques.

Unit III: [12 Periods]
Three-Dimensional Concepts – Display Methods – Three Dimensional and Stereoscopic Views – Object Representations – OpenGL Programs – Three-Dimensional Transformations – Basic Transformations – OpenGL Programs – Three-Dimensional Viewing – 2D and 3D Graphics – Viewing Pipeline – Viewing Coordinate – Projections – View Volume – Clipping.

Unit IV: [12 Periods]

Visible Surface Detection Methods – Introduction – Back-Face Detection Method – Z-buffer Method – A-Buffer Method – Scan line Method – Painter's Algorithm – Binary Space Partitioning Method – Ray Casting Method – Warnock's Alogrithm – Floating Horizon Method – Octree Method – Wireframe Methods – Illuminaton and Color Models – Computer Animation and Realism.

Unit V: [12 Periods]

Multimedia Systems – Introduction – Multimedia System Architecture – Defining Objects for Multimedia Systems – Multimedia Data Interface Standards – Multimedia Databases – Multimedia Input and Output Technologies – Data and File Formats – Multimedia Compression and Decompression – Multimedia Authoring, User Interface and Hypermedia Messaging: Multimedia Authoring – User Interface Design – Hypermedia Messaging.

Textbook:

1. D.Evangeline, S.Anitha, " Computer Graphics and Multimedia – Insights, Mathematical Models and Programming Paradigms, PHI Learning Private limted, (2016)

Reference Book:

1. Donald Hearn and Pauline Baker M, Computer Graphics", Prentice Hall, New Delhi, (2007).
2. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, KelvinSung, and AK Peters, Fundamentals of Computer Graphics, CRC Press, (2010).
3. effrey McConnell, Computer Graphics: Theory into Practice, Jones and Bartlett Publishers, (2006).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**2**	**1**				**3**				**1**	**2**		**1**
CO2		**2**	**1**	**2**	**3**		**2**	**1**	**1**	**3**		**3**	**2**
CO3	**3**	**3**		**2**	**3**	**1**		**2**	**3**		**1**	**2**	
CO4	**1**		**3**		**1**		**3**		**2**		**3**	**2**	
CO5	**3**		**2**	**1**		**2**		**3**		**2**			**3**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective – I Software Testing	**4**	**5**	**5**	**0**	**Theory**

Introduction:

To study concepts in software testing. Testing is the most time consuming and expensive part of software development. To discuss various software testing issues and solutions in software to expose the students for different software testing tools and techniques. To expose the advanced software testing topics, such as Technical testing, Reviews etc.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To Select and apply appropriate structural design techniques so tests provide adequate levels of confidence, via code coverage and design coverage.
CO2	:	The Technical test analyst is concerned with analytical techniques for both static and dynamic Analysis
CO3	:	Effectively participate in technical reviews with developers and architects for quality
CO4	:	To find defects in that work product before it serves as a basis for further project activity, though other goals can also apply
CO5	:	This Test tools that might be used by all testers by using tools and techniques

Unit I: [12 Periods]

The Technical Test Analyst's Tasks in Risk-based Testing – Structure-Based Testing – Introduction – Conditional Coverage – Decision Condition Coverage – Modified Condition – Multiple Condition Coverage – Path Testing – API Testing – Selecting a Structure-Based Technique – A Final Word on Structural Testing.

Unit II: [12 Periods]

Analytical Techniques – Introduction – Static Analysis – Control flow Analysis – Data flow Analysis – Static Analysis to improve Maintainability – Call Graphs – Dynamic Analysis – Memory Leak Detection – Wild Pointer Detection – Dynamic Analysis.

Unit III: [12 Periods]

Quality Characteristics for Technical Testing – Introduction – Security Testing – Security Issues – Reliability Testing – Maturity – Fault Tolerance – Recoverability - Efficiency Testing – Modeling the System – Maintainability Testing – Portability Testing – General Planning Issues.

Unit IV: [12 Periods]

Reviews – Introduction – Using Checklists in Reviews – Some General Checklist items for design and Architecture Reviews – Deutsch's Design Review Checklist – Some General Checklist Items for Code Reviews – Marick's Code Review Checklist – The open Laszlo Code Review Checklist.

Unit V: [12 Periods]

Test Tools and Automation – Integration and Information Interchange between Tools – Defining the Test Automation Project – Preparing for a Test Automation Project – Automation architectures – Fault Seeding and Fault injection Tools - Specific Test Tools – Tools for Web Testing.

Textbook:

1. Jamie L. Mitchell, Rex Black, "Advanced Software Testing – Vol.3", 2nd Edition, Rocky Nook, (2015).

Reference Books:

1. Limaye L G, "Software Testing – Principles, Techniques and Tools", Tata Mc-Graw Hill Education Pvt. Ltd., New Delhi, (2009).
2. Srinivasan Desikan, Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson Publisher, Pearson India, (2005).
3. Naresh Chauhan, "Software Testing – Principles and Practices", Oxford HED, Second edition, (2016).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**2**	**1**			**1**			**2**	**1**	**1**	**2**	**2**	
CO2	**1**		**1**	**3**		**3**	**2**		**2**				**2**
CO3		**2**		**1**		**1**	**2**	**3**		**3**	**3**	**2**	
CO4			**3**		**1**	**2**	**3**			**2**		**3**	**2**
CO5	**3**	**2**		**1**	**3**			**1**	**3**		**3**	**1**	**3**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective – I - Cloud Management and Security	**4**	**5**	**5**	**0**	**Theory**

Introduction:

To analyses the problem of establishing trustworthy Cloud, for addressing this problem focusing on mechanisms for treating the security challenges, discusses foundation frameworks and mechanisms for remote attestation in Cloud and establishing Cloud trust anchors, and lastly providing a framework for establishing a trustworthy provenance system and describes its importance in addressing major security challenges such as forensic investigation, mitigating insider threats and operation management assurance.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcomes

CO1	:	To Presents a high level view for Clouds and federated Clouds which is useful for professionals, decision makers and students
CO2	:	To Includes illustrations and real life deployment scenarios to bridge the gap between theory and practice
CO3	:	To Extracts, defines and analyses the desired properties and management services of Cloud computing and its associated challenges and disadvantages
CO4	:	To Analyses the risks associated with Cloud services and deployment types and what could be done to address the risk for establishing a trustworthy Cloud computing
CO5	:	To Provides a research roadmap for establishing the next generation trustworthy Cloud computing

Unit I: [12 Periods]

Introduction – Cloud Management – Cloud Structure – Infrastructure Components – Cloud Layers – Cloud Relations – Cloud Dynamics –Data Types – Fundamentals of Cloud management – Cloud Management Services – Virtual Control Center – Prerequisite Input Data for Management Services – Management of User Requirements.

Unit II: [12 Periods]

Cloud properties – Introduction – Adaptability Property – Resilience Property – Scalability Property – Availability Property – Reliability Property – Security and Privacy Property – Business Model – Automated Management Services – Virtual Layer Self-managed Services – Virtual Services Interdependency – Application Layer Self-managed Services – Application Services Interdependency – Security and Privacy by Design – Multi-tier Applications Deployment in the cloud – Main Challenges and Requirements.

Unit III: [12 Periods]

Cloud Security Fundamentals – Background – Topics Flow – Trusted Computing – Challenges for Establishing Trust in Clouds – Effects of Cloud Dynamics on Trust Relationships – Challenges – Establishing Trust in Clouds – Organization Requirements – Framework Requirements – Device Properties – Framework Architecture – Required Software Agents – Framework Workflow – Discussion and Analysis.

Unit IV: [12 Periods]

Clouds Chains of Trust – Introduction – Software Agents Revision – Roots of and Chains of Trust Definition – Intra-Layer Chains of Trust – Trust Across Layers – Provenance in Clouds – Motivating Scenarios – Log Records Management and Requirements – Framework Domain Architecture – Framework Software Agents – Framework Workflow – Threat Analysis – Discussion and Future Directions.

Unit V: [12 Periods]

Insiders – Introduction – Insiders Definition – Conceptual Models – Practical Examples: Real-Life Examples – OpenStack – Amazon Web Services – Component Architecture – Prototype – Case Study – Scenario – Home Healthcare Architecture in the Cloud – Insiders Analysis for Home Healthcare – Cloud Threats.

Textbook:

1. Imad M.Abbadi, "Cloud Management and Security", John Wiely & Sons, Ltd, First Edition, (2014).

Reference Book:

1. Dan C.Marinescu," Cloud Computing: Theory and Practice Solutions to Exercises and Problems", (2013).
2. Kief Morris, "Infrastructure as Code: Managing Servers in the cloud", O'Reilly, First Edition, (2016).
3. Raghuram Yeluri, "Building the Infrastructure for Cloud Security: A Solutions view", First edition, Apress, (2014).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**2**	**1**	**3**		**3**		**1**		**1**	**2**		**3**	
CO2			**2**	**2**		**3**		**2**	**2**		**1**		**2**
CO3	**3**		**1**		**2**	**1**		**1**		**2**		**2**	**1**
CO4	**1**	**2**		**1**		**2**	**3**	**2**		**1**	**3**		**2**
CO5		**3**		**3**	**1**		**2**		**3**		**2**	**1**	**3**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective – I - Cloud Security	**4**	**5**	**5**	**0**	**Theory**

Introduction:

This course cloud computing has drawn the attention of many business organization and normal users of computers in the recent past. Security aspects of cloud computing have always been subjected to many criticisms. Hence it becomes important for any security professional to possess an understanding of the cloud architecture and methods to secure the same. The aforementioned fact evident the need for the course.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Understand the overview of incident response.
CO2	:	Able to Plan and prepare for all stages of an investigation - detection, initial response and management interaction
CO3	:	Analyse and Investigate web server attacks, DNS attacks and router attacks and also can learn the importance of evidence handling and storage
CO4	:	Able Monitor network traffic and detect illicit servers and covert channels
CO5	:	Understand the basics elements of network forensics

Unit I: Introduction to Virtualization Security [12 Periods]

Introduction to Virtualization, impact and business benefits of Virtualization in the context of Security, Risks of Virtualization including attacks on Virtualization infrastructure, Hyper jacking and Virtual Machine jumping. Hyper jacking attacks like Blue Pill, Sub Virt, Vitriol, attacks on Virtualization features and compliance and Management challenges. Strategies and counter measures for addressing Virtualization risks, securing hypervisors, virtual machines threats, vulnerabilities and mitigation measures

Unit II: Introduction to Cloud Security [12 Periods]

Introduction to Cloud Computing, various Cloud Delivery models including Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) in the context of Security, Cloud deployment models – public, private and hybrid in the context of Security, Trusted Cloud Initiative (TCI) and Cloud Trust Protocol (CTP), Transparency as a Service (TaaS) and Security as a Service (SecaaS), Cloud Security, Incident and Response (Cloud SIRT), Cloud Data Governance and Governance, Risk and Compliance (GRC) Stack, top threats to Cloud Security, comparison of traditional IT and Cloud Security.

Unit III: Cloud Security Architecture [12 Periods]

Architectural considerations, Cloud storage and data security, identity management and access control, autonomic security, encryption and key strategies, secure connection, Privacy in Cloud, architecture changes for different Cloud deployment models, Business Continuity Management and Disaster Recovery in the Cloud, OpenStack Cloud Security, Cloud forensics

Unit IV: Cloud Security Control [12 Periods]

Introduction to Cloud Controls Matrix, 13 domains of Security controls, fundamental security principles, deterrent, preventive, detective and corrective security controls for Cloud computing, assessing security risk of a cloud provider

Unit V: Security of Cloud Services [12 Periods]

Cloud Platform and Infrastructure security-physical environment, networking, computing, virtualization, storage, risks and countermeasures, Cloud application security, Cloud secure development lifecycle, Cloud application architecture, multi-factor authentication, SSO, Understanding legal challenges involved in Cloud, liability, copyright, data protection, IPR, data portability, inter-country legal frameworks, personal data protection and privacy, data controller and processor, contracts, provider's insolvency risk

TEXT BOOKS:

1. GautamShroff, Enterprise Cloud Computing Technology Architecture Applications [ISBN: 978-0521137355]
2. Virtualization Security: Protecting Virtualized Environments by Dave Shackleford, Sybex (4 December 2012)
3. OpenStack Cloud Security by Fabio Alessandro Locati, Packt Publishing Limited (28 July 2015)
4. Cloud Security – A comprehensive Guide to Secure Cloud Computing by Ronald L. Krutz and Russel Dean Vines, Wiley, 2010

REFERENCES:

1. Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach [ISBN: 0071626948]
2. Tim Mather, Subra Kumaraswamy, Shahed Latif, Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance [ISBN: 0596802765]
3. Ronald L. Krutz, Russell Dean Vines, Cloud Security [ISBN: 0470589876]

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**1**	**2**	**3**		**3**		**1**		**1**	**2**		**3**	
CO2		**1**	**2**	**2**		**3**		**2**	**2**		**1**		**2**
CO3	**3**		**1**		**2**	**1**			**3**	**2**		**2**	**1**
CO4	**2**			**1**		**2**	**3**	**2**		**1**	**3**		**2**
CO5		**3**		**3**	**1**		**2**		**3**		**2**	**1**	**3**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective –I - Storage Management and Security	**4**	**5**	**5**	**0**	**Theory**

Introduction:
This course aims at learning the fundamental concepts of information storage and retrieval, storage network technologies and virtualization and the issues specific to efficient information retrieval and storage security.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Explain the basic information storage management and retrieval concepts.
CO2	:	Illustrate storage networking technologies and storage virtualization
CO3	:	Explain the concept the recovery management
CO4	:	Implement secure storage network framework
CO5	:	Develop storage infrastructure solution for the real time application

Unit I: Storage System [12 Periods]
Introduction to information storage and management, storage system environment, data protection: raid, intelligent storage system.

Unit II: Network Storage and Virtualization [12 Periods]
Storage networking technologies and virtualization, storage networks, network attached storage, IP SAN, content addressed storage, storage virtualization

Unit III: Business Community [12 Periods]
Introduction to business continuity, backup and recovery, local replication, remote replication

Unit IV: Storage Security [12 Periods]
Securing the storage infrastructure, storage security framework, risk triad, storage security domains, security implementation in storage networking

Unit V: Storage Infrastructure Management [12 Periods]
Managing the storage infrastructure, monitoring the storage infrastructure, storage management activities, developing an ideal solution, concepts in practice

Text Books:

1. EMC Education Services, Information Storage and Management: Storing, Managing, and Protecting Digital Information in Classic, Virtualized, and Cloud Environments, 2nd Edition John Wiley & Sons, ISBN-10: 1118094832. ISBN-13: 978-1118094839
2. John Chirillo, Scott Blaul, Storage Security: Protecting SAN, NAS and DAS, Wiley Publishers, 2003, ISBN-10: 0764516884. ISBN-13: 978-0764516887
3. David Alexander, Amanda Finch, David Sutton, Andy Taylor, Information Security Management Principles, The British Computer Society, 2013, ISBN-13: 9781780171753. ISBN-10: 1780171757

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**2**	**1**	**3**		**3**		**1**		**1**	**2**	**2**	**3**	
CO2			**2**	**2**		**3**		**2**	**2**		**1**		**2**
CO3	**3**		**1**		**2**	**1**		**1**	**3**	**2**		**2**	**1**
CO4	**1**	**2**		**1**		**2**	**3**	**2**		**1**	**3**		**2**
CO5		**3**		**3**	**1**		**2**		**3**		**2**	**1**	**3**

ELECTIVE - II

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective II – Wireless Network Security	**4**	**5**	**5**	**0**	**Theory**

Introduction:

This course presents network security protocols and cryptographic communication mechanisms for realizing specified security properties in wireless and mobile networks, such as secrecy, integrity, authentication, privacy, crypto key distribution, and access control. The course will study a selection of security functionalities and principles, adapted from current best practice in personal area networks, local area networks, and global mobile networks. In addition we seek to include interesting security protocols and mechanisms emerging in the Internet developments.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To identify some of the factors driving the need for network security
CO2	:	To provide knowledge of information security technology and methods for communication systems that provide services for mobile users by wireless access networks.
CO3	:	Bluetooth devices will eliminate the need for cables and provide a bridge to existing networks.
CO4	:	To knowledge and understanding of security mechanisms and protocols in wireless communication networks.
CO5	:	To appreciate the contribution of Wireless Communication networks to overall technological growth.

Unit I: [12 Periods]

Network Security: Introduction – Weaknesses in Network Security – Relevant Resources – Objectives of a Security Strategy – Security Aspects Concerning the Internet. WLAN: WLAN Basic Principles – IEEE 802.11 Overview – Wireless Fidelity – WMAN – Key Terminology – Architecture and Components – Security Requirements – Recent Developments – Applications – Checklist.

Unit II: [12 Periods]

Mobile Phones: Context – Basic Principles – Communication Structure – Device Architecture – Smartphones - Communication Protocols – GMS – GPRS – UMTS – Services – SMS/EMS/MMS – WAP – i-mode – Mobile Phones and WLAN – Infrastructure – Terminal devices – Threats and Protection – Special Case Blackberry – VoIP – Security Check.

Unit III: [12 Periods]

Bluetooth: Introduction – Technical Basics – Protocols – System Topology – Connecting to the Network – Version 5.0 – Security Aspects – Instruments – Risk Potentials Countermeasures. Infra

Red: Background – IrDA – General Considerations – Protocol – Applications – Terminal Devices – Preconditions – Communicating – Security Aspects.

Unit IV: [12 Periods]

Near Field Communication: Introduction – Technology – Specifications – Security Aspects. Security Policy: Introduction – Security Requirements – Risks – Measures – Scope – Normative References – Information and Communication Security – Physical Security – Documentation – Processes – Commitment – Wireless Security.

Unit V: [12 Periods]

Emergency management in Communication Networks: Emergency Management Systems – Standards – ISO 22301 – Further Standards and Methodologies Concerning IT Security – Requirements for Businesses – Analysis before Planning – Management Responsibilities – BCM Overview – Training and Testing – Intermediate Conclusions – The Emergency Process.

Textbook:

1. Wolfgang Osterhage, "Wireless Network Security," CRC Press, A Science Publishers Book, Second Edition, (2018).

Reference Book:

1. Y. Xiao, X. Shen, D. Z.Du, "Wireless Network Security", Springer International, Edition, (2005).
2. Lei Chen, JiahuangJi, Zihong Zhang, "Wireless Network Security", Springer Science & Business Media, (2013).
3. Levente Buttyán and Jean-Pierre Hubaux, "Security and Cooperation in Wireless Networks", Cambridge University Press,(2012).
4. James Kempf, "Wireless Internet Security: Architectures and Protocols", Cambridge University Press, (2008).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1		**3**	**2**		**1**		**3**		**3**	**3**	**2**	**3**	
CO2	**1**	**2**		**1**		**2**	**2**	**1**	**1**		**1**		**2**
CO3	**3**	**1**	**3**		**2**	**1**			**3**	**2**		**1**	
CO4				**2**				**3**			**3**		**3**
CO5	**2**		**1**	**3**		**3**	**1**	**2**		**1**		**2**	

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective II – Streaming Analytics	**4**	**5**	**5**	**0**	**Theory**

Introduction:

The collection and processing of this data has a number of application areas for require an infrastructure and method of analysis specific to streaming data. To allow a fairly broad range of potential users and implementers in an organization to gain comfort with the complete stack of applications. Real time streaming applies as much to the development of new analyses as it does the data itself.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To Understand the need for stream computing and comprehend the architecture of Steam Analytics
CO2	:	To building data flow management pipelines for streams.
CO3	:	Processing streaming data.
CO4	:	Delivering the results of streaming analytics
CO5	:	To allow for maintaining sets and histograms with real-time updates.

Unit I: [12 Periods]

Introduction to Streaming Data: Sources of Streaming Data – Why Streaming Data is Different – Infrastructures and Algorithms. Streaming a Analytics Architecture: Designing Real-Time Streaming Architectures – Real-Time Architecture Components – Features of a Real-Time Architecture – Languages of Real-Time Programming – A Real-Time Architecture Checklist.

Unit II: [12 Periods]

Service Configuration and Coordination: Motivation for Configuration and Coordination Systems – Maintaining Distributed State – Apache Zookeeper. – Data-Flow Management in Streaming Analysis: Distributed Data Flows – Apache Kafka: High-Throughput Distributed Messaging – Apache Flume: Distributed Log Collection.

Unit III: [12 Periods]

Processing Streaming Data: Distributed Streaming Data Processing – Processing Data with Storm – Processing Data with Samza. – Storing Streaming Data: Consistent Hashing – "NoSQL" Storage Systems – Other Storage Technologies – Choosing a Technology – Warehousing.

Unit IV: [12 Periods]

Analysis and Visualization: Delivering Streaming Metrics – Streaming Web Applications – Visualizing Data – Mobile Streaming Applications. – Exact Aggregation and Delivery: Timed Counting and Summation – Multi-Resolution Time-Series Aggregation – Stochastic Optimization – Delivering Time-Series Data – Statistical Approximation of Streaming Data.

Unit V: [12 Periods]

Approximating Streaming Data with Sketching: Registers and Hash Functions – Working with Sets – The Bloom Filter – Distinct Value Sketches – The Count-Min Sketch – Other Applications. – Beyond Aggregation – Models for Real-Time Data – Forecasting with Models – Monitoring – Real-Time Optimization – Introduction – End User License Agreement.

Textbook:

1. Byron Ellis, "Real-Time Analytics: Techniques to Analyze and Visualize Streaming Data", Wiley, First Edition, (2014).

Reference Books:

1. Sherif Sakr, "Large Scale and Big Data: Processing and management, CRC Press, (2014).
2. Bill Franks, "Taming the Big Data Tidal Wave Finding Opportunities in Huge Data Streams with Adavnced Analytics", Wiley, (2012).
3. Jure Leskovec, Anand Rajaraman, Jeffrey D.Ullman, "Mining of assive Datasets, Cambridge University Press, (2014).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**1**	**3**	**2**		**1**		**3**		**3**	**1**	**2**	**3**	
CO2	**2**	**2**		**1**		**2**	**2**	**1**	**1**		**1**		**2**
CO3	**3**	**1**	**3**		**2**	**1**			**3**	**2**		**1**	
CO4		**1**		**2**	**3**			**2**		**3**	**3**		**3**
CO5	**2**		**1**	**3**		**3**	**1**			**1**		**2**	

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective – II 3D Animation Essentials	**4**	**5**	**5**	**0**	**Theory**

Introduction:
3D is everywhere in video games, movie and television special effects, mobile devices, etc. Many aspiring artists and animators have grown up with 3D and computers, and naturally gravitate to this field as their area of interest. Bringing a blend of studio and classroom experience to offer you thorough coverage of the 3D animation industry to create compelling and realistic 3D imagery.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Serves as the first step to understanding the language of 3D and computer graphics (CG)
CO2	:	Covers 3D animation basics: pre-production, modeling, animation, rendering, and post-production
CO3	:	Dissects core 3D concepts including design, film, video, and games
CO4	:	Examines what artistic and technical skills are needed to succeed in the industry
CO5	:	Offers helpful real-world scenarios and informative interviews with key educators and studio and industry professionals

Unit I: [12 Periods]
3D Animation Overview – Defining 3D Animation – Exploring the 3D Animation Industry – The History of 3D Animation – The Essentials and beyond – Understanding the Production Pipeline's Components – Working in 3D Animation Preproduction – Working in 3D Animation Production – Working in 3D Animation Postproduction – Using Production Tools – The Essentials and Beyond.

Unit II: [12 Periods]
Understanding Digital Imaging and Video – Understanding Digital Imaging – Pixels – Raster Graphics vs. Vector Graphics – Anti-Aliasing – Basic Graphic-File Formats – Bit Depth – Color Calibration – Understanding Digital Video – The Essentials and Beyond – Using Principles of Fine Art and Traditional Animation – Building a Good story.

Unit III: [12 Periods]
Using Pre-visualization Techniques – Basic Shot Framing – Camera Movements – Editing – Modeling – Polygons –Subdivision Surfaces –Modeling Workflows – Texturing – Shaders – Texture Maps – Texturing Workflows.

Unit IV: [12 Periods]

Rigging – Parenting – Pivot Positions – Skeleton System – Forward and Inverse Kinematics – Deformers – Constraints – Scripting – Expressions – The Basic Rigging Workflow – Animation – The Basic Animation Workflow – Animation Techniques – Creating Visual Effects – Lighting – Rendering.

Unit V: [12 Periods]

Choosing a Computer – Using Monitors/Displays – Working with Graphics Tablets – Using 3D Scanners – Setting up Render Farms – Finding Data Storage solutions – Choosing Software – Using Motion Capture – Creating Stereoscopic 3D – Integrating Point-Cloud Data – Providing Real-Time Capabilities – Working in Virtual Studios.

Textbook:

1. Andy Beane "3D Animation Essentials", John Wiley & Sons, Inc., (2012)

Reference Book:

1. Williams, R, "The Animator's Survival Kit", Faber and Faber Ltd, First Edition, (2001).
2. Scott, J, "How to write for Animation", The Overlook Press, First Edition, (2002).
3. Ranjit Singh, "The Art of Animation Production Management", MacMillan India, First Edition, (2013).
4. Kupeeberg, M, "A Guide to Computer Animation", Focal Press, First Edition, (2002).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1		**3**	**2**		**1**		**3**		**3**	**3**	**2**	**3**	
CO2	**1**	**2**		**1**		**2**	**2**	**1**	**1**		**1**		**2**
CO3	**3**	**1**	**3**		**2**	**1**			**3**	**2**		**1**	
CO4				**2**				**3**			**3**		**3**
CO5	**2**		**1**	**3**		**3**	**1**			**1**		**2**	

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective – II - Tools for Software Testing	**4**	**5**	**5**	**0**	**Theory**

Introduction:
Selenium Web Drivers integration with development and build tools due to its neat and clean object-oriented design. It integration with development and build tools such as Ecllipse, Maven and Microsoft visual studio. These tools provide an easy way to develop test automation frameworks and extend the capabilities of Selenium.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To find elements on a Web page and interact with these elements
CO2	:	To provide a very comprehensive API for working with different types of web elements performing user interactions
CO3	:	To build a great user interfaces, developers use features similar
CO4	:	To build a highly flexible and robust API to extend the features and commands
CO5	:	The combination of various other tools to build test automation Frameworks.

Unit I: [12 Periods]
Getting Started – Introduction – Finding Elements – Using Browser tools for inspecting elements and page Structure – Finding elements using the find elements method – Finding links – Locating elements using text – Using JQuery selectors.

Unit II: [12 Periods]
Working with elements – Introduction – Automating dropdowns and lists – Working with Selenium API – Introduction – Checking an element's presence – Synchronizing Tests – Synchronizing a test with custom-expected conditions.

Unit III: [12 Periods]
Working with Alerts, Frames and Windows – Introduction – Identifying and handling frames – Data-Driven Testing – Introduction – Creating a data-driven test using JUnit – Using the Page Object Model – Using the Loadable Component class.

Unit IV: [12 Periods]
Extending Selenium – Introduction – Creating an extension class for web tables – Comparing images in Selenium – Testing HTML5 Web Applications – Web storage-testing local storage – Behavior-Driven Development.

Unit V: [12 Periods]

Integration with Other Tools – Introduction – Configuring Jenkins for continuous integration – Cross-Browser Testing – Introduction – Setting up Selenium grid server for parallel executions – Testing Applications on Mobile Browsers

Textbook:

1. Unmesh Gundecha, "Selenium Testing Tools Cookbook", Second Edition, Packt Publishing ltd., (2015).

Reference Book

1. Glenford J. Myers, Corey Sandler, Tom Badgett, " The Art of software testing", 3rd Edition,John Wiley & Sons, (2021).
2. James A.Whittaker, "How to break software: A Practical guide to testing", Addison Wesley,(2002).
3. Vijay Shinde, "A Software Tester's Journey from getting a job to becoming a Test Leader", All right reserved, (2013).
4. Lee Copeland, " A Practitioner's Guide to Software Test Design", Artech House Computing library, (2003).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**1**				**3**		**2**		**2**	**2**		**1**	
CO2		**1**	**3**	**1**		**3**		**1**	**1**		**3**	**1**	**3**
CO3	**3**		**2**	**3**	**1**		**2**		**3**	**1**	**2**	**3**	
CO4		**2**		**2**	**1**	**2**		**3**		**3**			**2**
CO5	**2**	**3**	**1**				**1**	**2**		**1**	**3**	**2**	**3**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective - II - Deploying and Managing a Cloud Infrastructure	**4**	**5**	**5**	**0**	**Theory**

Introduction:

It is an excellent resource for IT professionals seeking to tap into the demand for cloud administrators. It provides the latest expert perspectives on enterprise-level mobile computing, and covers the most essential topics for building and maintaining cloud-based systems.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To know the fundamentals of cloud computing in the context of virtualization technology
CO2	:	It covers the open-source and proprietary solutions and cloud implementation
CO3	:	It includes performance metrics across compute, network, storage and resources
CO4	:	It provides hands-on practical knowledge of the intricacies of setting up and managing your own cloud infrastructure
CO5	:	To create and configure multiple virtual networks within the same cloud

Unit I: [12 Periods]

Understanding Cloud Characteristics – Basic Terms and Characteristics – Objects Stroage Concepts – To Grasp the Cloud-Fundamental Concepts – The True Nature of the Cloud – Virtualization and Scaability – The Cloud Hpervisor – Key Benefits of Implementing Hypervisors – Foundations of Cloud Computing.

Unit II: [12 Periods]

Within the Cloud: Technical Concepts of Cloud Computing – Technical basics of Cloud and Scalable Computing – The Cloud Infrastructure – Cloud Management – Understanding Cloud Management Platforms – Service-Level Agreements – Policies and Procedures – Managing cloud Workloads – Managing Devices..

Unit III: [12 Periods]

Diagnosis and Performance Monitoring – Performance Concepts – Disk Performance – Impact of Configuration Changes – Cloud Delivery and Hosting Models – On-Premises vs. Off-Permises Hosting – Accountability and Responsibility based on Delivery Models – Security Differences between models – Functionality and Performance validation.

Unit IV: [12 Periods]

Practical Cloud Knowledge: Install, Configure and Manage – Setting up the Cloud – Virtual Resource Migration – Virtual Components of the cloud – Hardware Management – Cloud Hardware Resources – Management Differences between Public, Private and Hybrid Clouds – Tiering – File Systems.

Unit V: [12 Periods]

Storage Provisioning and Networking – Cloud Storage Concepts – Cloud vs SAN Storage – Cloud Provisioning – Cloud Storage Technology – Cloud Storage Gateway – Cloud Security and Privacy – Testing and Deployment – Overview of Deployment Models – Cloud management Strategies – Cloud Architecture – Cloud Deployment Options – Creating and Deploying Cloud Services.

Textbook

1. Zafar Gilani, Abdul Salam, Salman UI Haq, "Deploying and Managing a Cloud Infrastructure", Sybex,(2015).

Reference Book:

1. Greg Schulz, "Cloud and Virtual Data Storage Networking", Auerbach Publications, [ISBN: 978-1439851739], (2011).
2. Marty Poniatowski, "Foundations of Green IT" Prentice Hall, 1st edition, [ISBN: 978-0137043750], (2009).
3. EMC, "Information Storage and Management" Wiley, 2nd edition, [ISBN: 978-0470294215], (2012).
4. Volker Herminghaus, Albrecht Scriba, "Storage Management in Data Centers" Springer; editioN [ISBN: 978-3540850229], (2009).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**1**		**3**		**3**		**2**		**2**	**2**		**1**	
CO2		**1**		**2**		**3**		**1**	**1**		**3**	**1**	**3**
CO3	**3**		**2**	**1**	**1**		**2**		**3**	**1**	**2**	**3**	
CO4		**2**		**3**	**2**	**2**		**3**		**3**			**2**
CO5	**2**	**3**	**1**				**1**	**2**		**1**	**3**	**2**	**3**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective - II - Forensic Psychology & Crime Assessment	**4**	**5**	**5**	**0**	**Theory**

Introduction:

This course aims to introduce the overview of forensic psychology and its applications. The importance of psychological assessment in gauging criminal behavior. The tools and techniques required for detection of deception. The critical assessment of advanced forensic techniques like polygraphy, narco analysis and brain electrical oscillation signatures.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Explain the basics of psychology and its issues.
CO2	:	Interpret the various psychology of evidence.
CO3	:	Analyze various criminal behaviours related with psychological disorders.
CO4	:	Explain various crimes pertaining to biological factors.
CO5	:	Interpret various deception tools for detection.

Unit I: Basics of Forensic Psychology [12 Periods]

Definition and fundamental concepts of forensic psychology and forensic psychiatry, psychology and law, ethical issues in forensic psychology, assessment of mental competency, mental disorders and forensic psychology

Unit II: Psychology of Evidence [12 Periods]

Eyewitness testimony, confession evidence. Criminal profiling. Psychology in the courtroom, with special reference to section 84 IPC

Unit III: Psychology and Criminal Behavior [12 Periods]

Psychology and criminal behavior psychopathology and personality disorder, psychological assessment and its importance, serial murderers, psychology of terrorism

Unit IV: Factors of Crime [12 Periods]

Biological factors and crime, social learning theories, psycho social factors, abuse, juvenile delinquency, theories of offending (social cognition, moral reasoning), child abuse (physical, sexual, emotional), juvenile sex offenders, legal controversies

Unit V: Detection of Deception [12 Periods]

Detection of deception tools for detection of deception, interviews, non-verbal detection, statement analysis, voice stress analyzer, hypnosis. polygraphy, operational and question formulation techniques, ethical and legal aspects, the guilty knowledge test. narco analysis and brain electrical oscillation signatures, principle and theory, ethical and legal issues

Text Books:

1. A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, "Scientific Evidence in Civil and Criminal Cases", The Foundation Press, Inc., New York, 2009, ISBN-10: 1599413337. ISBN-13: 978-1599413334
2. R. Saferstein, "Criminalistics: An Introduction to Forensic Science", Pearson 10th edition, 2010, ISBN-10: 0135045207. ISBN-13: 978-0135045206
3. J.C. DeLadurantey and D.R. Sullivan, "Criminal Investigation Standards, Harper & Row", New York, 1980, ISBN-10: 0060416092. ISBN-13: 9780060416096
4. J. Niehaus, "Investigative Forensic Hypnosis", CRC Press, Boca Raton, 1999, ISBN-10: 0849381339. ISBN-13: 9780849347962
5. J.A. Siegel, P.J. Saukko and G.C. Knupfer, "Encyclopedia of Forensic Science", Volume 2, Academic Press, London, 2000, ISBN-10: 012227217X. ISBN-13: 9780122272172

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**1**	**2**			**3**		**2**		**2**	**2**		**1**	
CO2		**1**	**3**	**1**		**3**		**1**			**3**	**1**	**3**
CO3	**3**		**2**	**3**	**1**		**2**		**3**	**1**	**2**	**3**	
CO4		**2**		**2**	**1**	**2**	**3**	**3**		**3**			**2**
CO5	**2**	**3**	**1**				**1**	**2**		**1**	**3**	**2**	**3**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective – II - Fingerprints and Impressions	**4**	**5**	**5**	**0**	**Theory**

Introduction:
This course aims to introduce the concepts of evidence collections in terms of fingerprints, impressions and to examine the collected evidence.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Explain the history and classifications of fingerprints for identification and comparison.
CO2	:	Distinguish the types of evidence and preserve it for further development
CO3	:	Examine various footwear impressions
CO4	:	Examine various tire impressions, track the evidence and recover the impressions
CO5	:	Infer various applications in crime detections like lip prints, ear prints for investigations

Unit I: Introduction to Fingerprints [12 Periods]
History and development of fingerprints- structure of skin- elements of fingerprinting, classification of fingerprint patterns, classification of fingerprints, identification and comparison, Poroscopy, AFIS introduction, history, operation, search technology, palm prints, administration and networking.

Unit II: Fingerprint Evidence [12 Periods]
Types of evidentiary fingerprints, development of latent fingerprints, physical and chemical methods, visualization methods of illumination, photography, preservation and lifting of fingerprints development techniques on porous and non-porous surfaces, development on adhesive surface development with blood and grease contamination, development of latent fingerprints on dead body digital imaging of fingerprints, case histories.

Unit III: Footwear Impressions [12 Periods]
Footwear impressions introduction, forms of footwear impressions, information from footwear impressions, location and recovery of footwear impressions, enhancement methods, preparation of exemplars, the examination process, case histories

Unit IV: Tire Impressions [12 Periods]

Tire impressions introduction, original equipment tires, replacement tires and tire construction, tread nomenclature and sidewall information, tread wear indicators, retreated tires, tire reference material and databases, tire track evidence and recovery, known tires and exemplars, tire impressions examination process, case histories.

Unit V: Lip and Ear Prints [12 Periods]

Lip prints introduction, history, scope, application in crime detection, ear prints introduction, history, morphology of ear, ear prints location, producing standards from suspects, identification and comparison bite marks, introduction, significance, judicial acceptance, description of prototypical bite marks evidence collection on victim and suspects, identification and comparison, case histories

Text Book:

1. Saferstein, Richard, Criminalistics. An Introduction to Forensic Science, 5th Edition, Prentice Hall, 2014. ISBN-10: 0133458822. ISBN-13: 978-0133458824
2. Saferstein, R, "Handbook of Forensic Science", (Vol 1, 2, 3) ISBN-10: 0130910589 (Vol-1)ISBN-13: 978-0130910585 (Vol-1), ISBN-10: 013112434X (Vol-2), ISBN-13: 978-0131124349 (Vol-2). ISBN-10: 013220715X (Vol-3), ISBN-13: 978-0132207157 (Vol-3)
3. Eckert, "An Introduction to Forensic Science", CRC Press, 2nd Edition, ISBN-10: 0849381010. ISBN-13: 978-0849381010
4. James, S. H. and Nordby, J, Forensic Science: An Introduction to Scientific and Investigative Techniques, 4th Edition, CRC Press, ISBN-10: 9781439853832. ISBN-13: 978-1439853832

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**2**	**3**			**3**		**2**		**2**	**2**		**1**	
CO2	**1**		**3**	**1**		**3**		**1**	**2**		**3**	**1**	**3**
CO3	**3**		**2**	**3**			**2**		**3**	**1**	**2**	**3**	
CO4		**2**		**2**	**1**	**1**	**3**	**3**	**1**	**3**	**1**		**2**
CO5	**2**	**3**	**1**		**2**	**3**	**1**	**2**		**1**	**3**	**2**	**3**

SEMESTER –IV

ELECTIVE - III

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective III - VMware Network Virtualization	**4**	**5**	**5**	**0**	**Theory**

Introduction:
It introduces the concept of Software Defined Data Center. The course is designed to introduce basic and fundamental concepts associated with SDDC, Network Virtualization, Security, and the types of business challenges the solution solves by illustrating several use cases. It understands VMware NSX use cases.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To understand the VMware Network Virtualization Fundamentals
CO2	:	To associate with networking concepts such as firewall rules, demilitarized zones, VLANs and access control lists
CO3	:	To presents an alternative addresses for this challenge with simplicity and familiarity to these contending areas
CO4	:	To define the model of on-demand networking and security services for automated environment
CO5	:	To focus on the design and operation of their data center network as a single entity

Unit I: [12 Periods]
What is Network Virtualization – Virtualization as the New Reality – The server Virtualization Revolution – Virtualization in Network Technology – Defining Network Virtualization – VMware NSX Architecture. – Rethinking Network Constructs – Layer 2 Connectivity – Layer 3 Connectivity – Introducing Distributed Logical Routing – Introducing Logical Load Balancing.

Unit II: [12 Periods]
Virtualization as Security Control – The Evolution of Firewalls – Statefulness Defined – Demilitarized Zone – Classic Data Center Security Designs – Anatomy of a Modern Cyber Attack – The Zero Trust Model – A Real World Analogy: Secure Airport – Introducing the VMware – NSX Distributed Firewall – Security On-Demand: Service Composer – SpoofGuard.

Unit III: [12 Periods]
Virtual Networks, Real Extensions – The Evolution of Secondary – The Cold Site – The Warm Site – The Hot-Backup Site – The Virtualized Hot Site – The Active Site – Networking Challenges in Active-Standby Sites – Spanning Tree Protocol and Failure Domains – Layer 2 Extension and Traffic Behavior – Provisioning Complexity – Vmware NSX for Active-Active Sites – Layer 2 VPNs.

Unit IV: [12 Periods]

Industrializing Networks – Automating IT- Pre-Provisioned Networks – Challenges and Limitations – Automating Physical Networks – Example of an automated Network Topology – Network Automation with VMware NSX – VMware NSX integration with Automation stacks – vRealize Automaton – OpenStack.

Unit V: [12 Periods]

One Network – Data Center Network Evolution – Three-Tier Design – Three-Tier Design with Multi-Chassis link Aggregation – Ethernet Fabrics – Data Center Consolidation through Network Virtualization – An Open Data Center Network Architecture – Consolidated NETWORK Operations – Vmware vRealize Log Insight – Vmware vRealize Network Insight.

Textbook:

1. Gustavo A.A.Santana, VCIX-NV and CCIE 8806," VMware NSX Network Virtualization Fundamentals", vmware Press,(2017).

Reference Book:

1. Jonathan Morin, Shinie Shaw, "Network Virtualization for dummies", A Wiley & Sons, 2nd VMware Special Edition, (2018).
2. Dr.Balwinder Singh Sodhi, "Virtualization and Cloud Computing", CC BY-SA License: https://creativecommons.org/licenses/by-sa/3.0/, (2017).
3. Rajendra Chayapathi, Syed F Hassan, Paresh Shah, "Network Functions Virtualization (NFV): A touch of SDN", Ist Edition, (2016).
4. Nigel Cain, Alvin Morales, Michel Luescher, Damian Flynn ,"Building a Virtualized Network Solution Book", Series Editor, Microsoft,

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**2**		**1**		**3**		**2**		**2**	**1**		**2**	**1**
CO2	**3**	**1**	**3**	**1**		**3**		**1**			**3**	**1**	**3**
CO3			**2**	**3**	**1**		**2**	**2**	**3**		**2**	**3**	
CO4	**1**	**2**		**2**	**1**	**2**	**3**	**1**		**3**	**1**		**2**
CO5	**2**	**3**			**2**		**1**	**2**	**1**	**1**	**3**	**2**	**3**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective-III -Business Intelligence and Data Analytics	**4**	**5**	**5**	**0**	**Theory**

Introduction:
This course is designed to introduce students to business intelligence concepts and provide students with an understanding of data Analytics along with associated techniques and their benefits to organizations of all sizes.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To know the concepts and components of Business Intelligence
CO2	:	To the delivery of business value and competitive advantage in modern organizations.
CO3	:	Text Analytics and Text mining, to different organizational contexts.
CO4	:	To synthesize knowledge to address ethical dilemmas and resolutions.
CO5	:	To examine the knowledge Management and Collaborative Systems

Unit I: [12 Periods]
An Overview of Business Intelligence, Analytics and Data Science: Sports Analytics – Changing business environments and evolving needs for decision support and analytics – Evolution of computerized decision support to Analytics/Data Science – A framework for business intelligence – Analytics Overview – A brief introduction to Big Data Analytics – An overview of the Analytics Ecosystem – Resources and Links – Vendors, Products and Demos – Periodicals – Foundations and Technologies for Decision Making.

Unit II: [12 Periods]
Business Reporting, Visual Analytics and Business Performance Management: Self-Service Reporting Environment Saves Millions for Corporate Customers – Business Reporting Definitions and Concepts – Data and Information Visualization – Different Types of Charts and Graphs – The Emergence of Data Visualization and Visual Analytics – Performance Dashboards – Business Performance Management – Performance Measurement – Balanced Scorecard – Six Sigma as a Performance Measurement System – Techniques for Predictive Modeling.

Unit III: [12 Periods]

Text Analytics, Text Mining, and Sentiment Analysis: Concepts and Definitions – Natural Language Processing – Text Mining Applications – Text Mining Process – Sentiment Analysis Overview – Sentiment Analysis and Speech Analytics – Web Mining Overview – Web Content and Web Structure Mining – Search Engines – Social Analytics and Social Network Analysis – Social Media Analytics.

Unit IV: [12 Periods]

Model-Based Decision Making: Optimization and Multi-Criteria Systems – Decision Support Systems Modeling – Structure of Mathematical Models for Decision Support – Mathematical Programming Optimization – Multiple Goals, Sensitivity Analysis, What-If Analysis, and Goal Seeking – Modeling and Analysis: Heuristic Search Methods and Simulation – Automated Decision Systems and Expert Systems.

Unit V: [12 Periods]

Knowledge Management and Collaborative Systems: Information Technology (IT) in Knowledge Management – Tools for Indirect Support of Decision Making – Big Data and Analytics – Fundamentals of Big Data Analytics – Big Data Technologies – Data Scientist – Big Data and Stream Analytics – Emerging Trends and Future Impacts – Location-Based Analytics for Organizations – Impacts of Analytics in Organizations: An Overview.

Textbook:

1. Ramesh Sharda, Dursun Delen, Efraim Turban, "Business Intelligence, Analytics and Data Science: A Managerial Perspective", Pearson Education, Fourth Edition, (2018).

Reference Book:

1. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", John Wiley & Sons, (2011).
2. David Loshin, "Business Intelligence: The Savvy Manager's Guide", Newnes, (2012).
3. Elizabeth Vitt, Michael Luckevich, Stacia Misner, "Business Intelligence", O'Reilly Media, Inc, (2010).
4. Rajiv Sabhrwal, Irma Becerra-Fernandez "Business Intelligence", John Wiley &Sons, (2010),
5. Swain Scheps, "Business Intelligence for Dummies", Wiley, (2013).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1	2	1			2		2		2	2		1	
CO2	1	3	2		1	3		1			3	1	3
CO3	3		3	1	3		2		3	1	2	3	
CO4		2		2	3	2		3	1	3			2
CO5	2	1	1	3			1	2		1	3	2	3

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective –III - Virtual Reality	**4**	**5**	**5**	**0**	**Theory**

Introduction:
It can provide our minds with direct access to digital media in a way that seemingly has no limits. However, creating compelling VR experiences is an incredibly complex challenge. When VR is done well, the results are brilliant and pleasurable experiences that go beyond what we can do in the real world.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To describe imaginary worlds that only exist in computers and our minds
CO2	:	They can experience symptoms of motion sickness, which is referred to as VR sickness or cyber sickness
CO3	:	To develop using simple application that allows users to easily build their own ideas and explore in virtual settings
CO4		To design and iterative upon effective VR applications with human elements
CO5	:	To design an iterative process is to develop a prototype.

Unit I: [12 Periods]
What is Virtual Reality – History – Overview of various Realitiies – Perception: Objectives and subjective reality – Perceptual models and Processes – Perceptual Modalities – Perception of Space and Time – Perceptual stability, Attention and Action – Perception: Design Guidelines.

Unit II: [12 Periods]
Adverse Health Effects: Motion sickness – Eye Strain, Seizures and Aftereffects – Hardware Challenges – Latency – Measuring Sickness – Summary of factor that contribute to Adverse Effects – Examples of Reducing Adverse effects – Adverse health effects: Design Guidelines.

Unit III: [12 Periods]
Content Creation: High-level concepts of Content Creation – Environmental Design – Affecting Behavior – Personal Wayfinding Aids – Center of Action – Field of view – Transitioning to VR Content Creation – Content Creation: Design Guidelines.

Unit IV: [12 Periods]
Interaction: Human-centered interaction – Intuitiveness – Norman's Pricciples of Interaction Design – VR Interaction Concepts – Interaction Fidelity – Input Devices – Interaction Patterns and techniques – Interaction: Design Guidelines.

Unit V: [12 Periods]

Iterative Design: Philosophy of Iterative Design – VR is both an art and a science – The Define Stage – Assessment and Feasibility – The Make Stage – The Learn Stage – Iterative Design: Design Guidelines.

Textbook:

1. Jason Jerald, Ph.D. , " The VR Book : Human-Centered Design for Virtual Reality", ACM Books series, First edition, (2016).

Reference Book:

1. Burdea, G. C. and P. Coffet, " Virtual Reality Technology", Second Edition. Wiley-IEEE Press, (2003/2006).
2. Alan Craig, William Sherman and Jeffrey Will, "Developing Virtual Reality Applications", Foundations of Effective Design, Morgan Kaufmann, (2009).
3. John Vince, "Virtual Reality Systems ", Pearson Education Asia, (2007).
4. Grigore C. Burdea, Philippe Coiffet, "Virtual Reality Technology", Wiley Inter Science, 2nd Edition, (2006).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1		**2**	**3**		**3**		**2**		**2**	**2**		**1**	
CO2	**2**	**1**		**1**		**3**		**1**			**3**		**3**
CO3	**1**		**2**	**3**			**2**		**3**	**1**	**2**	**2**	
CO4	**3**			**2**	**1**	**2**		**3**		**3**			**2**
CO5	**2**	**3**	**1**			**1**		**2**	**1**		**3**	**2**	**3**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective – III Agile Testing	**4**	**5**	**5**	**0**	**Theory**

Introduction:

To understand where testing started in agile teams and how it has evolved to become the cornerstone of agile development and continuous delivery of products. Part of successful agile development is an organization's ability to learn what's most critical for long-range success with agile testing.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To keep up with fast-changing technology and new contexts for agile development
CO2	:	To consider the T-shaped skills needed to succeed with testing
CO3	:	To build your exploratory testing capabilities by practice
CO4	:	To manage test technical debt for especially as it relates to test automation
CO5	:	To provide living documentation that can help meet regulatory requirements

Unit I: [12 Periods]

How agile Testing has evolved – The importance of Organizational Culture – The importance of Organizational Culture – Roles and Competencies – T-Shaped Skill Set – Thinking Skills for testing – Facilitating – Solving Problems – Technical Awareness – Automation and Coding Skills.

Unit II: [12 Periods]

How to learn – Learning Styles – Levels of Precision for Planning – Different Points of View – Using Models to help plan – Are we building the right thing? – Tools for Customer Engagement – The Expanding Testers Mindset – Business Analysis Skills.

Unit III: [12 Periods]

The Power of using Examples – Guiding Development with Examples – Exploratory Testing – Creating Test Charters – Other types of Testing – Concurrency Testing – Technical Debt in Testing – Work on the Biggest Problem – Pyramids of Automation.

Unit IV: [12 Periods]

Test Automation Design Patterns and Approaches – Involve the whole Team – Selecting Test Automation Solutions – Solutions for Teams in Transition – Agile Testing in the Entreprise - Agile Testing on Distributed Teams – Agile Testing for Mobile and Embedded Systems.

Unit V: [12 Periods]

Agile Testing in Regulated Environments – The "Lack of Documentation" Myth – Agile Testing for Data Warehouses and Business Intelligence Systems – Testing and DevOps – Visualize your Testing – Putting it all together – Confidence-Building practices.

Textbook:

1. Janet Gregory, Lisa Crispin, " More Agile Testing: Learning Journeys for the whole Team", Addison-Wesley, Pearson, (2015).

Reference Books:

1. Robert C. Martin , "Agile Software Development, Principles, Patterns, and Practices", Alan Apt Series, (2011).
2. Chhavi Raj Dosaj, " Agile Testing: ISTQB Agile Tester Extension Certificate", SPD, (2017).
3. Lisa Crispin, Janet Gregory, " Agile testing: A practical guide for testers and agile teams", Addision-Wesley, 1st Edition, (2009).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1		**2**			**3**		**2**		**2**	**2**		**1**	
CO2		**3**		**1**		**3**		**1**			**3**	**1**	**3**
CO3	**3**		**2**	**3**	**1**		**2**		**3**	**1**	**2**	**3**	
CO4	**1**	**1**	**3**		**1**	**2**		**3**		**3**	**1**		**2**
CO5	**2**		**1**			**1**		**2**		**1**	**3**	**2**	**3**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective – III - Hybrid Cloud	4	5	5	0	**Theory**

Introduction:

The cloud is dramatically reshaping the enterprise IT landscape. After an early rush to the public cloud, the majority of companies are settling on a hybrid cloud strategy that can utilize resources from traditional enterprise IT, private clouds, public cloud providers, and CSPs.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To support traditional enterprise applications versus cloud-native applications
CO2	:	To provides a prescription for creating a mature hybrid cloud.
CO3	:	To provides the glue that allows your hybrid cloud to operate as a single, cohesive unit.
CO4	:	To provides the glue that allows your hybrid cloud to operate as a single, cohesive unit.
CO5	:	To provides specific recommendations for choosing public clouds, CSPs, and SaaS providers.

Unit I: [12 Periods]

Is It Time Embrace Hybrid Cloud? – What this Report Covers – The Cloud is Reshaping Enterprise IT – What is a Hybrid Cloud? – Applications and the Hybrid Cloud – The state of Hybrid Cloud

Unit II: [12 Periods]

Understanding the Hybrid Cloud – What are the benefits of Hybrid Cloud? Why is Hybrid Cloud the Perferred Enterprise Model? – A Strategy for Hybrid Cloud Success.

Unit III: [12 Periods]

Assessing your Hybrid Cloud needs – Access the current state of your Operations – Access your Future Workload needs – Creating a Workload Decision Matrix – Seek Buy-In – Establish your High-Level Hybrid Cloud Goals.

Unit IV: [12 Periods]

Designing your Hybrid Cloud: On-Premises and Private Cloud – Choosing a Cloud Operating System – Modernizing Datacenters – Availability, Data Protection and Compliance – Designing your Hybrid Cloud: Public Clouds, CSPs and SaaS.

Unit V: [12 Periods]

Getting Serious about DevOps – What is DevOps – The importance of Infrastructure to DevOps – Adapting your Organization to Hybrid Cloud – Why Organizational Change is Necessary – Organizational Changes for DevOps.

Textbook

1. Philip Trautman, "Designing and Building a Hybrid Cloud", O'Reilly, (2018).

Reference Book:

1. Alok Shrivastwa, "Hybrid Cloud for Architects", Packt Publishing, first edition, (2018).
2. Judith S.Hurwitz, Marcia Kaufman, Fern Halper, Daniel Kirsch, " Hybrid Cloud for Dummies", 2nd Edition, John Wiley & Sons, (2010).
3. Manoj Hirway, "Hybrid Cloud for Developers", Packt,ISBN: 9781788830874, (2018).
4. Shreesh Dubey, Vijay Tandra Sistla, Shivam Garg, Aashish Ramdas, Mitch Tulloch, Series Editor, "Microsoft System Center: Data Protction for the Hybrid Cloud", First Edition, Microsoft Press, (2015).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**1**				**3**		**2**		**2**	**2**		**1**	
CO2		**1**	**3**	**1**		**1**		**1**			**3**	**1**	**3**
CO3	**3**		**2**	**3**	**1**		**2**		**3**	**1**	**2**	**3**	
CO4		**2**		**2**	**1**	**2**		**3**		**3**			**2**
CO5	**2**	**3**	**1**			**3**	**1**	**2**		**1**	**3**	**2**	**3**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective – III - Open Web Application Security Project (OWASP) Framework	**4**	**5**	**5**	**0**	**Theory**

Introduction:

To introduce to the various concepts of OWASP and security policy. To learn the basics and enforce the cryptographic techniques for authentication and authorization. To practice the configuration of security encrypted passwords and keys and log analysis process.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Understand the different security framework viz. OWASP
CO2	:	Explore the Automatic Generating process of Content Security Policy
CO3	:	Analyze the Policy for authentication and authorization
CO4	:	Configuration Security-Encrypt Passwords and Keys
CO5	:	Demonstrate the Security specific log and attack points

Unit I: Introduction to OWASP [12 Periods]

Different security framework, web application framework, mission; Injection Prevention- Safe from Interpretation by Browsers, Parameterized Query Functionality for SQL Statements, Safe from Interpretation by XML Processors, Query Functionality for LDAP Statements, Option to Disallow Newline Characters in Text File Logging; Input Validation- Configurable Validation for All Forms of User-Supplied Input, Use Whitelist Validation for File Paths and Names in File Handling Functionality

Unit II: HTTP Monitoring [12 Periods]

Specify an Encoding Format for Every HTTP Response Page, Not Accepting Characters with Illegal Byte Sequences, Detect HTTP Parameter Tampering, Automatically Generate Content Security Policy (CSP) Headers, Automatically Generate Content Security Policy (CSP) Headers, Specify a Default Maximum Payload Size

Unit III: Authentication and Authorization [12 Periods]

Enforce Default Deny Policy for Framework Managed Authorization, Provide Indirect Object Reference Functionality, Provide a Function That Hashes and Salts Input with Random Bytes; Session Management- Use Cryptographically Secure Random Numbers for Session IDs, Provide Automatic Anti-CSRF Tokens, Automatically Reset Session IDs After Authentication, Apply Http Only Flag to Session ID Cookie by Default, Provide Configurable Inactive and Absolute Session Timeouts

Unit IV: XML Specific [12 Periods]

Disable the Following Unsafe Features by Default; Cryptography- Transparent Database Encryption, Configurable Cryptographic Algorithms, TLS Protection Cheatsheet for TLS/SSL Implementations; Configuration Security-Encrypt Passwords and Keys Stored in Configuration Files; File Upload-Pluggable Anti Malware Scanning Solutions, Options to Disallow Saving Outside of a Specified Directory, Supports Pluggable Content Validation

Unit V: Security Specific Logs [12 Periods]

Security Specific Logs and Log All Attack Points Specified in AppSensor, Automatically Generate X-Frame-Options Header, Arithmetic Utilities that Protect Against Integer and Floating Point Overflow and Underflow, Pluggable Anti-Automation, Return Generic Error Pages by Default, Centralized Security Configuration Options

Textbook:

1. "OWASP Code Review", By OWASP Foundation, 2008

REFERENCES:

1. OWASP Testing Guide v3: Back to the OWASP Testing Guide Project: http://www.owasp.org/index.php/OWASP_Testing_Project
2. OWASP Testing Guide, By OWASP Foundation,2007

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1		**2**	**3**			**3**		**1**			**3**		**2**
CO2	**1**	**3**	**1**	**1**	**2**		**2**	**3**			**2**	**1**	
CO3	**2**			**2**	**1**	**1**			**2**	**2**	**1**	**3**	**3**
CO4	**3**		**2**		**3**		**1**	**2**		**1**	**2**		
CO5		**1**		**3**		**2**	**3**		**1**	**3**		**3**	**1**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective – III - End Point Security Management	**4**	**5**	**5**	**0**	**Theory**

Introduction:

To impart knowledge on the fundamental concepts of endpoint security. To provide with valuable insights on the various design principles and challenges of establishing the endpoint security. To demonstrate on the process of monitoring and analysing the logs to take preventive measures for managing the endpoint security.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Understand the concepts of endpoint security
CO2	:	Explore the methods of design principles for endpoint
CO3	:	Analyse the various challenges of establishing end point security
CO4	:	Monitoring the behaviour of various threats
CO5	:	Implementing the lifecycle process for end point security management

Unit I: Understanding Endpoint Security [12 Periods]

Introduction to end point security, four tenets of endpoint security – identity, access control, authentication and authorization, four pillars of endpoint security – endpoint hardening & resiliency and network prioritization & resiliency, complexities and additional risks to endpoint security due to BYOD and IoT, case studies

Unit II: Endpoint Security – Design Principles [12 Periods]

Using principle of least privilege in endpoint security, application whitelisting, standard secure system configurations, patch application and management, defense-in-depth, importance of preventive security controls and proactive approach to endpoint security design.

Unit III: Endpoint Security challenges and incidence response [12 Periods]

Endpoint application security challenges: Mobile app security, application virtualization security challenges, endpoint data security challenges, endpoint device security challenges, end point network security challenges, incident response procedure: Identify the behavior, detect malware or sign of compromise on endpoint, collect the evidence, and analyze the evidence, prepare forensic report.

Unit IV: Endpoint Security – Monitoring endpoint security [12 Periods]

Detect endpoint anomalies, threat intelligence, analyzing security events and data logs, endpoint security services, client to server services: policy, antivirus, client package, application control, file encryption key retrieval. Endpoint security ports, endpoint security tools.

Unit V: Endpoint Security Management [12 Periods]

Using lifecycle process for managing endpoint security, recognizing the integration challenges, risks and limitations, defining suitable policies and implementation measures including trustworthy network, measuring the effectiveness, analyzing the efficiency, improving endpoint security in a continual manner, controlling the endpoint ecosystem and changes, sustaining the endpoint security

Text Books:

1. The Four Pillars of Endpoint Security by Dan Griffin, Createspace Independent Pub (11 June 2013)
2. The Endpoint Security Paradox: Realising Implementation Success by Andrew Avanessian, Lulu.com (8 December 2016)
3. Defensive Security Handbook: Best Practices for Securing Infrastructure by Lee Brotherston, Amanda Berlin, Shroff/O'Reilly; First edition (2017)
4. Microsoft System Center 2012 Endpoint Protection Cookbook by Andrew James Plue, Packt Publishing Limited (16 October 2012)
5. Microsoft System Center Endpoint Protection Cookbook by Nicolai Henriksen, Packt Publishing Limited; 2nd Revised edition (19 December 2016)

REFERENCES:

1. Endpoint Security Complete Self-assessment Guide by Gerardus Blokdyk, Createspace Independent Pub (14 May 2017)

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1		**1**				**1**		**2**		**3**	**2**		
CO2	**1**	**1**	**3**		**1**		**2**		**3**			**1**	
CO3	**2**		**1**	**2**				**1**	**2**	**1**	**2**		**3**
CO4		**2**	**2**		**3**	**2**	**3**			**2**	**3**		
CO5	**3**	**1**		**1**			**2**		**1**	**3**	**3**	**3**	**1**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core Project	8	0	0	15	**Practical**

GUIDELINES FOR PROJECT WORK

1. The aim of the Project work is to acquire practical knowledge on the implementation of the programming concepts studied.
2. Each student should carry out individually one Project Work and it may be a work using the software packages that they have learned or the implementation of Concepts from the papers studied or implementation of any innovative idea.
3. The Project work should be compulsorily done in the Industry only under the supervision of the Department staff concerned.
4. The work has to be done in five reviews during IV Semester.
5. External Exam will be conducted as follows. End Semester Viva Voce
   - An End- semester Internal Viva-voce will be conducted at the end of IV semester for 200 marks.
   - Both the Internal (Respective Guides) and External Examiners (100) + (100) Should Conduct the Viva-Voce Examination at the last day of the practical session.
   - Along with the mark sheet an Annexure report containing the candidate‘s Register no and Title of the Project work should be sent to the Controller of Examinations by the Examiners and a copy of the same has to be retained in the Department.
   - No candidate will be allowed to change the title of the Project work after the completion of End- semester Viva.
   - For those absent on genuine grounds a common subliment End-Semester Viva-voce may be conducted at the COE for All degree by obtaining prior permission from the COE on the recommendations from the HODs of respective Department before the commencement of the next semester.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**1**		**2**	**1**		**2**	**3**		**3**		**1**	**1**	
CO2	**2**	**2**	**3**		**1**		**1**	**3**	**2**	**1**		**3**	**2**
CO3	**3**			**3**	**2**	**2**		**2**	**1**	**3**	**3**		
CO4		**3**		**2**		**1**		**1**		**2**	**2**	**2**	**3**
CO5	**1**	**2**	**1**			**3**	**2**		**3**			**3**	**1**

ADVANCED LEARNER COURSE

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Database Security	**2**	**0**	**0**	**0**	**Theory**

Introduction:

This course aims to provide fundamental security concepts and architectures that serve as building blocks to database security. Helps to use current database management system to design and configure the user and data permissions. Introduces the Operational components necessary to maximize database security using various security models

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Explain security problems in databases and various security models for securing databases
CO2	:	Analyze various security mechanisms to ensure database security using evaluation criteria
CO3	:	Explain various design approaches for securing OS, software, DBMS using security packages
CO4	:	Interpret various statistical database protection and Intrusion Detection systems.
CO5	:	Infer various Models For The Protection Of New Generation Database Systems

Unit I: The Database and DBMS Architecture [09 Periods]

Introduction to Database & DBMS Architecture, Hierarchical Database Management Systems, Network Database Management Systems, Relational Database Management Systems, Object-Oriented Database Management Systems, End-User Database Management Systems, Spreadsheets

Unit II: Concepts of Database Security [09 Periods]

Concept of Least Privilege in User ID for databases. Concept of NoSQL databases Differences from classical DBMS concepts with NoSQL, Advantages of NoSQL like Elastic Scaling, Big Data, Goodbye DBAs', Economics/Cost, Flexible Data models

Unit III: Concepts of NoSQL [09 Periods]

Non/ partial applicability of ACID (Atomicity, Consistency, Isolation, Durability) guarantees in NoSQL databases as compared to traditional RDBMS databases. Horizontal scalability benefits of NoSQL Databases compared to traditional Databases, Protecting Database - Understanding permissions, Creating and using database roles, using schemas for security, configuring cross-database security

Unit IV: Concepts of Key Value & Tuple Store Databases [09 Periods]

Concept of UnSQL or Unstructured Query Language, Concept of Key Value & Tuple Store Databases, Concept of Graph Databases, Concept of Multi-model Databases, Code and Data Encryption- Using service and database master keys, creating and using symmetric and asymmetric keys, creating and storing hash values, Authenticating stored procedure by signature

Unit V: SQL Server & Auditing [09 Periods]

Concept of Object Databases, Concept of Grid & Cloud Databases, Concept of XML databases, Concept of Multidimensional and Multi-value Databases

Auditing – Using the profiler to audit SQL server access, using DML trigger for auditing data modification, Using DDL triggers for auditing structure modification, configuring SQL server auditing

TEXT BOOKS:

1. Hassan A. Afyouni, *Database Security and Auditing*,India Edition, Cengage Learning, 2008, ISBN-10: 8131506657, ISBN-13: 978-8131506653
2. Database security by SilvanaCastano, 2nd Edition, Pub: Addison-Wesley Professional , 2008
3. Microsoft SQL server 2012 Security Cookbook by Rudi Bruchez, Pub: PACKIT publishing, 2012
4. Silvana Castano, MariagraziaFugini, Giancarlo Martella, PierangelaSamarati, *Database Security*, Diane Publication Company, 1995, ISBN-10: 0788165429. ISBN-13: 978-0788165429

REFERENCES:

1. Alfred Basta, Melissa Zgola, *Database security*, Delmar Cengage Learning, ISBN-10: 1435453905. ISBN-13: 978-1435453906
2.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**1**	**2**		**2**	**3**	**1**		**3**		**3**	**2**	**3**	
CO2	**3**	**1**	**1**	**3**	**3**	**2**		**1**	**2**	**2**	**1**		**2**
CO3	**2**	**3**		**2**	**2**		**1**	**3**	**1**		**3**	**2**	**1**
CO4	**3**		**2**	**1**		**3**	**3**		**2**	**3**	**1**		**2**
CO5		**2**	**3**		**1**	**2**		**3**	**1**			**3**	**3**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Security Architecture	**2**	**0**	**0**	**0**	**Theory**

Introduction:
To help students understand key elements involved in designing, implementing and managing a robust security architecture. To make it possible for students to learn various phases of building security architecture. To facilitate students, gain a thorough understanding how fundamental security principles are useful in contextual and conceptual security architecture.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Relate fundamental concepts of information and network security in designing security architecture
CO2	:	Apply their understanding of security principles in building a sustainable security architecture
CO3	:	Articulate the importance of managing the security architecture using policies
CO4	:	Articulate the importance of managing the security architecture using policies, processes and framework for effective
CO5	:	Articulate the importance of managing the security architecture using policies, processes and framework for efficient security.

Unit I: Introduction to Security Architecture: [09 Periods]
Origins of Architecture, managing complexity, information systems architecture, security architecture, benefits of architectural approach to information security, need for a holistic approach, security architecture model – SABSA, matrix, case studies

Unit II: Phased Approach To Build Security Architecture: [09 Periods]
Security Architecture – Business Drivers And Traceability, Using SABSA Model To Define A Development Process, Strategy And Concept Phase, Design Phase, Implementation Phase, Manage And Measure Phase, Overview Of Enterprise Security Architecture, Case Studies.

Unit III: Contextual and Conceptual Security Architecture: [09 Periods]
Business context, aligning business objectives with security architecture, operational risk and impact assessment, influence of business processes.

Workflow, organizational structure on security architecture, location and time dependencies, security architectural layering, entity model and trust framework, security domain model, case studies

Unit IV: Security Architecture Design-I: [09 Periods]

Logical-information flow, policies and services, application and system environment, security management and lifecycle, Physical-rules, mechanisms, policies**.**

Standards and procedure, user, platform and network infrastructure, Component-products and tools, Operations, case studies.

Unit V: Managing service provider: [09 Periods]

Managing service providers and third party security risks, balancing needs, requirements, risks and costs, impact of cloud, IoT and AI technologies on security architecture, case studies.

TEXT BOOKS:

1. Enterprise Architecture and Information Assurance: Developing a Secure Foundation by James A. Scholz, Auerbach Publications; 1 edition, 2013
2. Designing Security Architecture Solutions 1st Kindle Edition by Jay Ramachandran

REFERENCES:

1. Network Security Architectures (Networking Technology) 2nd Kindle Edition by Sean Convery
2. Threat Modeling: Designing for Security (MISL-WILEY) by Adam Shostack, Wiley, 2014

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1		**3**	**3**	**2**		**3**		**2**		**3**		**2**	
CO2	**1**		**2**	**3**	**1**		**2**		**3**		**2**		**2**
CO3	**3**	**2**		**1**		**2**		**1**	**2**	**3**	**2**	**1**	**3**
CO4	**2**	**1**	**3**	**2**	**2**	**1**	**3**	**2**	**1**	**2**	**3**	**2**	**2**
CO5			**1**		**3**		**1**				**1**	**3**	**1**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Mobile Device Forensics	**2**	**0**	**0**	**0**	**Theory**

Introduction:
This course aims to provide basic Concepts in Mobile Forensics, Mobile Device Data Storage, Identify, preserve, extract, analyze, and report data from mobile devices. It also talks about Acquiring Evidence from Mobile devices.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Explain open source software and android forensics
CO2	:	Explain various android hardware platforms and its specific devices.
CO3	:	Compare various security models to assess risk in SDK.
CO4	:	Explain various Android file systems and data structures.
CO5	:	Infer various security techniques for mobile devices

Unit I: Android and Mobile Forensics: [09 Periods]
Introduction, android platform, Linux, open source software and forensics, android open source project, internationalization, android market, android forensics

Unit II: Android Hardware Platforms [09 Periods]
Overview of core components, overview of different device types, read-only memory and boot loaders, manufacturers, specific devices

Unit III: Android Software Development Kit and Android Debug Bridge: [09 Periods]
Android platforms, software development kit (SDK), android security model, forensics and the SDK

Unit IV: Android File Systems and Data Structures: [09 Periods]
Data in the shell, type of memory, file systems, mounted file systems and directory structures. Android forensic techniques, procedures for handling an android device, imaging android USB mass storage devices, logical techniques, physical techniques

Unit V: Android Device Data and Application Security [09 Periods]
Data theft targets and attack vectors, security considerations, individual security strategies, corporate security strategies, app development security strategies. android application and forensic analysis: analysis techniques, FAT forensic analysis, YAFFS2 forensic analysis, android app analysis

TEXT BOOKS:

1 Andrew Hoog, John McCash, "Android Forensics Investigation, Analysis, and Mobile security for Google Android", Syngress, 2011, ISBN-10: 1597496510. ISBN-13: 978-1597496513

REFERENCES:

1 Satish Bommisetty, Rohit Tamma, Heather Mahalik "Practical Mobile Forensics", Packt Publishing Limited 21 July 2014. ISBN-10: 9781783288311. ISBN-13: 978-1783288311

2 Andrew Martin, "Mobile Device Forensics", SANS Institute 2009

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1			**3**	**2**		**3**		**2**		**3**	**2**		
CO2		**3**	**1**		**1**		**2**		**2**	**1**		**1**	**2**
CO3	**2**			**3**		**2**		**1**	**3**	**2**	**1**	**2**	**3**
CO4	**3**	**2**	**2**		**2**	**1**	**3**	**2**			**2**	**2**	
CO5	**1**	**2**		**1**			**1**		**1**	**3**		**3**	**1**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Web Application And Web Security	**2**	**0**	**0**	**0**	**Theory**

Introduction:
This course aims at learning web applications vulnerability and malicious attacks and the basic web technologies used for web security

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Explain Knowledge of web applications vulnerability and malicious attacks.
CO2	:	Apply the basic web technologies used for web application development
CO3	:	Analyze the basic concepts of mapping the application.
CO4	:	Illustrate attacking authentication and access control.
CO5	:	Identify the data store attacks relate to SQL.

Unit I: Web Application Security [09 Periods]
The evolution of web applications, common web application functions, benefits of web applications, web application security, core defense mechanisms, handling user access authentication, session management, access control, handling user input, varieties of input approaches to input handling, boundary validation. multistep validation and canonicalization, handling attackers, handling errors, maintaining audit logs, alerting administrators, reacting to attacks

Unit II: Web Application Technologies [09 Periods]
The HTTP protocol, HTTP requests, HTTP responses, HTTP methods, URLs, REST, HTTP headers, cookies, status codes, HTTPS, HTTP proxies, HTTP authentication, web functionality, server-side functionality, client side functionality, state and sessions, encoding schemes, URL encoding, Unicode encoding, HTML encoding, Base64 encoding, Hex encoding, remoting and serialization frameworks

Unit III: Mapping the Application [09 Periods]
Enumerating content and functionality, web spidering, user-directed spidering, discovering hidden content, application pages versus functional paths, discovering hidden parameters, analyzing the application, identifying entry points for user input, identifying server-side technologies, identifying server-side functionality, mapping the attack surface

Unit IV: Attacking Authentication [09 Periods]

Authentication technologies, design flaws in authentication mechanisms, bad passwords, brute-forcible login, Verbose failure messages, vulnerable transmission of credentials, password change, functionality, forgotten password functionality, "Remember Me" functionality, user impersonation, functionality incomplete, validation of credentials, nonunique usernames, predictable usernames, predictable initial passwords, insecure distribution of credentials. Attacking access controls: common vulnerabilities, completely unprotected, functionality identifier-based functions, multistage functions, static files, platform misconfiguration, insecure access control methods.

Unit V: Attacking Data Stores [09 Periods]

Injecting into interpreted contexts, bypassing a login, injecting into SQL, exploiting a basic vulnerability injecting into different statement types, finding SQL injection bugs, fingerprinting the database, the UNION operator, extracting useful data, extracting data with UNION, bypassing filters, second-order SQL injection, advanced exploitation beyond SQL injection: escalating the database attack, using SQL exploitation tools, SQL syntax and error reference, preventing SQL injection

TEXT BOOK:

1. DefyddStuttard, Marcus Pinto, "The Web Application Hacker's Handbook: Finding And Exploiting Security Flaws", 2nd Edition, Wiley Publishing, ISBN-10: 1118026470. ISBN-13: 978-1118026472

REFERENCES:

1. Andres Andreu, Professional Pen Testing for Web application, Wrox Press, ISBN-10: 0471789666. ISBN-13: 978-0471789666
2. Carlos Serrao, Vicente Aguilera, Fabio Cerullo, Web Application Security 1st Edition, Springer, ISBN 978-3-642-16119-3
3. Joel Scambray, Vincent Liu, Caleb Sima, Hacking exposed, McGraw-Hill; 3rd Edition, ISBN-10: 0071074406, ISBN-13: 978-0071074407
4. Simson Garfinkel, Web Security Privacy and Commerce, 2nd Edition, O'Reilly, 2011, ISBN-10: 0596000456. ISBN-13: 978-0596000455
5. Richard sinn, Software Security Theory Programming and Practice, Cengage Learning, ISBN-10: 8131508498. ISBN-13: 978-8131508497
6. Hassan A. Afyouni, Database Security and Auditing, Cengage Learning, ISBN-10: 8131506657. ISBN-13: 978-8131506653

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**1**		**3**	**2**		**3**		**2**		**3**	**2**		**2**
CO2	**2**	**2**	**1**		**1**	**1**	**2**		**2**	**1**		**1**	**3**
CO3	**2**	**1**		**1**	**3**	**2**	**2**	**1**	**3**	**2**	**1**	**3**	
CO4		**3**	**2**		**2**	**1**	**3**	**2**			**2**	**2**	
CO5				**1**			**1**		**1**	**3**		**3**	**1**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	File System Forensic Analysis	**2**	**0**	**0**	**0**	**Theory**

Introduction:
This course aims at learn fundamental of computer file system and storage analysis of FAT, NTFS, Ext and UNF.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Compare the different file systems for storing information
CO2	:	Implementation of FAT file system concepts and analysis.
CO3	:	Illustrate the concept of NTFS file system an analysis.
CO4	:	Explain Ext file system category and Ext Data structure
CO5	:	Illustrate the concept of UFS file system and analysis

Unit I: Volume Analysis [09 Periods]
Introduction, background, analysis basics, summary. PC-based partitions, DOS partitions, analysis considerations, apple partitions, removable media, server-based partitions, BSD partitions, Sun Solaris slices, GPT partitions, multiple disk volumes, RAID, disk spanning

Unit II: File System Analysis–FAT Concepts and Analysis [09 Periods]
What is a file system?, file system category, content category, metadata category, file name category, application category, application-level search techniques, specific file systems
FAT concepts and analysis: introduction, file system category, content category, metadata category, file name category, the big picture, other topics. FAT data structures: boot sector, FAT32 FSINFO, FAT, directory entries, long file name directory entries

Unit III: NTFS Concepts and Analysis [09 Periods]
NTFS concepts: introduction, everything is a file, MFT concepts, MFT entry attribute concepts, other attribute concepts, indexes, analysis tools
NTFS analysis: file system category, content category, metadata category, file name category, application category, the big picture, NTFS data structures, basic concepts, standard file attributes, index attributes and data structures, file system and meta data files

Unit IV: Ext2 and Ext3 Concepts and Analysis [09 Periods]
Introduction, file system category, content category, metadata category, file name category, application category. the big picture, Ext2 and Ext3 data structures, superblock, group descriptor tables, block bitmap, inodes, extended attributes, directory entry, symbolic link, hash trees, journal data structures

Unit V: UFS1 and UFS2 Concepts and Analysis [09 Periods]

Introduction, file system category, content category, metadata category, file name category, the big picture. UFS1 and UFS2 data structures, UFS1 superblock, UFS2 superblock, cylinder group summary, UFS1 group descriptor, UFS2 group descriptor, block and fragment bitmaps, UFS1 inodes, UFS2 inodes, UFS2 extended attributes, directory entries

TEXT BOOKS:

1. Brian Carrier, File System Forensic Analysis, Addison Wesley, 2005, ISBN-10: 0321268172. ISBN-13: 978-0321268174

REFERENCES:

1. MachteltGarrels, Introduction to Linux A Hands-On Guide, TSTC Publishing, 2009. ISBN-13: 9781934302620. ISBN-10: 1934302627

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	**3**		**3**	**2**		**2**	**3**	**2**	**3**	**3**	**2**		**2**
CO2	**1**	**2**		**3**	**1**	**3**	**2**		**2**	**1**		**1**	**3**
CO3	**2**	**3**	**2**	**1**	**3**	**1**			**3**	**2**	**1**	**3**	
CO4			**1**	**3**	**2**		**1**	**2**			**2**	**2**	**3**
CO5	**3**	**1**	**3**		**3**	**2**	**2**	**3**	**1**	**3**		**3**	**1**